Gas Journal

VOL. 284. 107th YEAR. LONDON, DECEMBER 14, 1955. No. 4828. PRICE 1/6

TECHNOLOGY DEPT

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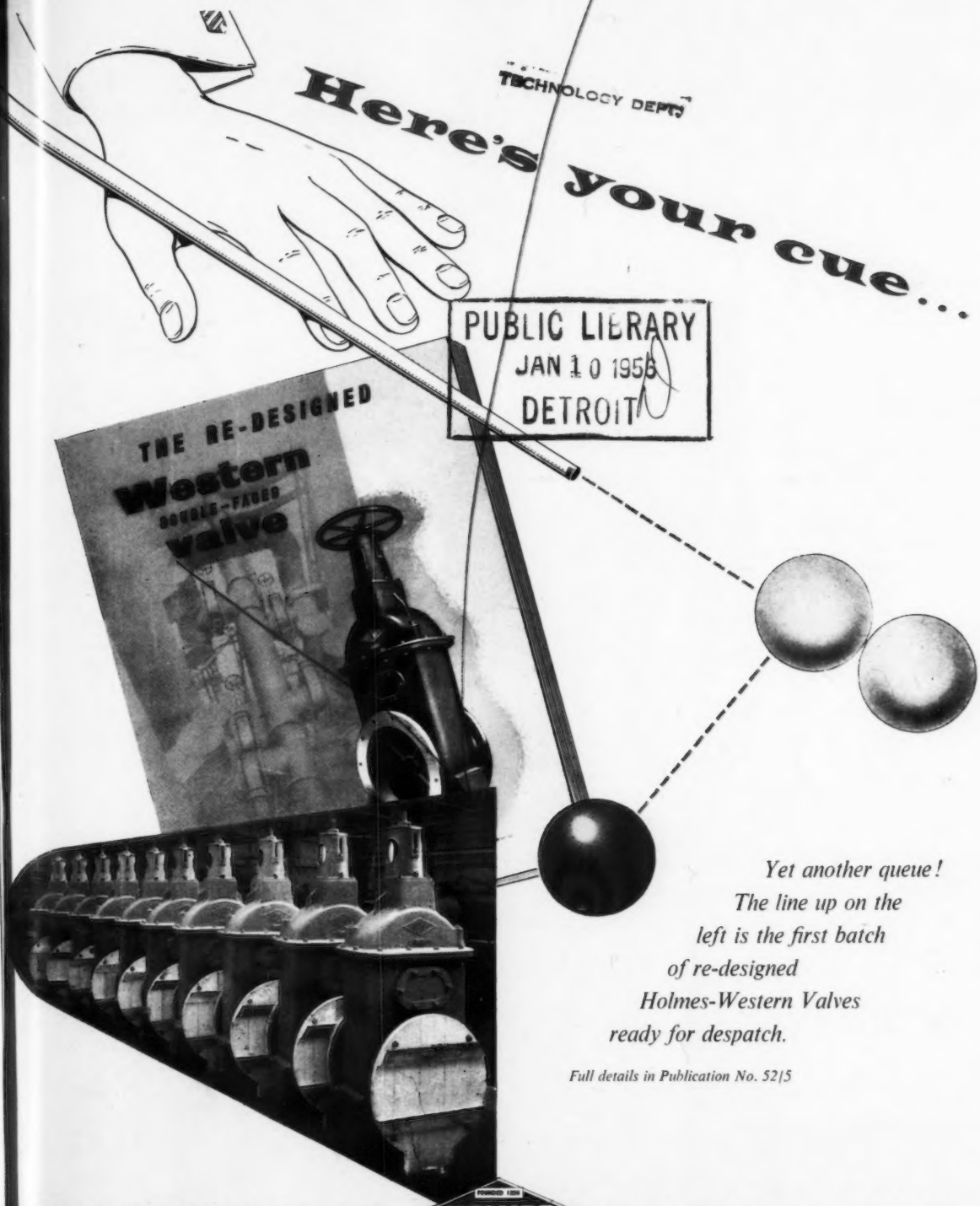
DETROIT

Here's your cue...



Yet another queue! The line up on the left is the first batch of re-designed Holmes-Western Valves ready for despatch.

Full details in Publication No. 52/5

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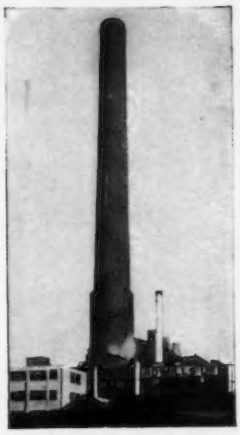
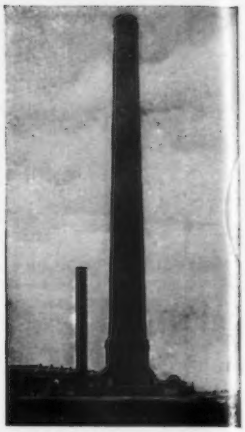
Left : Trial borings for reconstruction of Coventry Cathedral.





Two of the largest chimneys in the British Isles; on foundations of Francois Concrete Piles (left) and Francois Cementation Piles (right)

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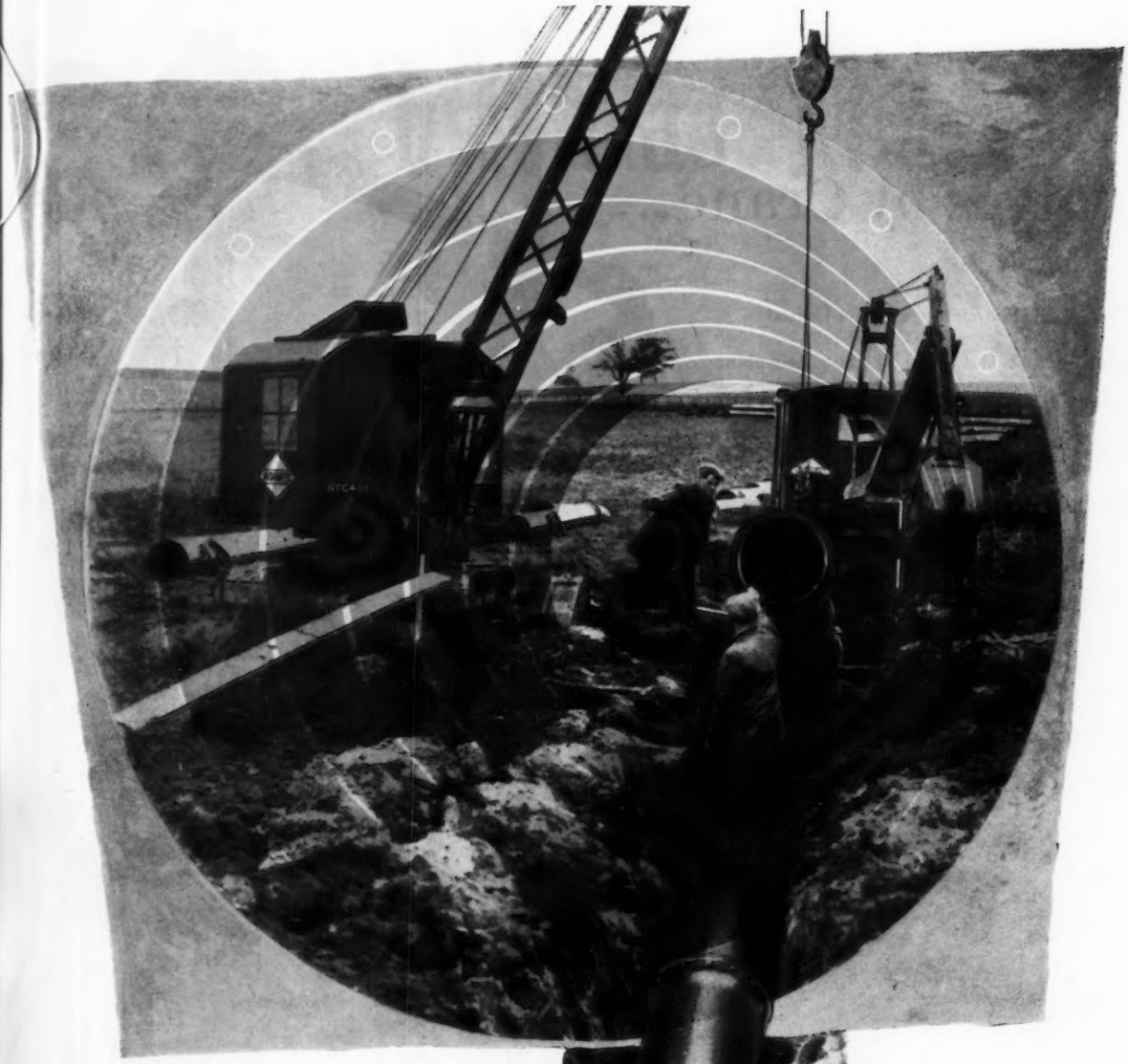

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Photo of the boiler feed pump installation at the United Phosphate & Malt Co. Ltd.

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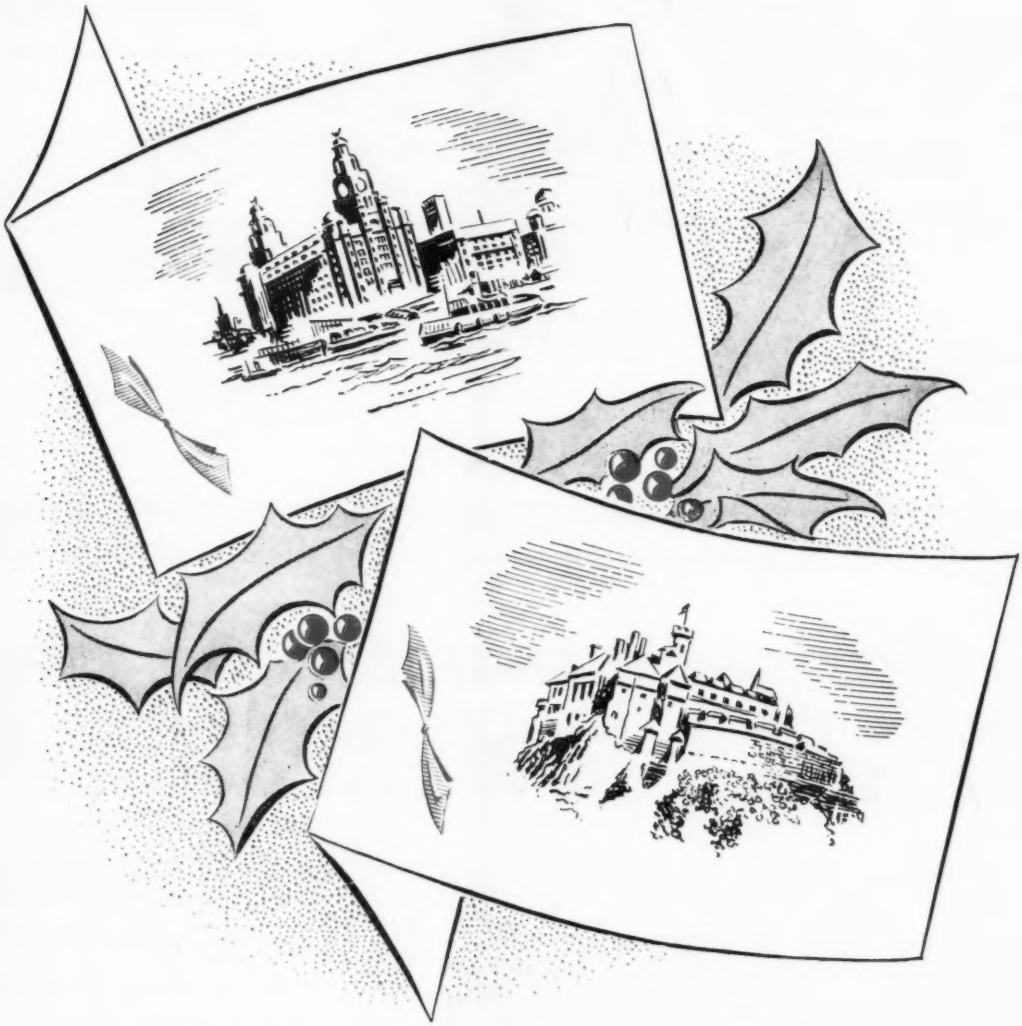
At Christmas Time



We send our Greetings, with Kindest Thoughts and Sincere Wishes for Christmas and the New Year.

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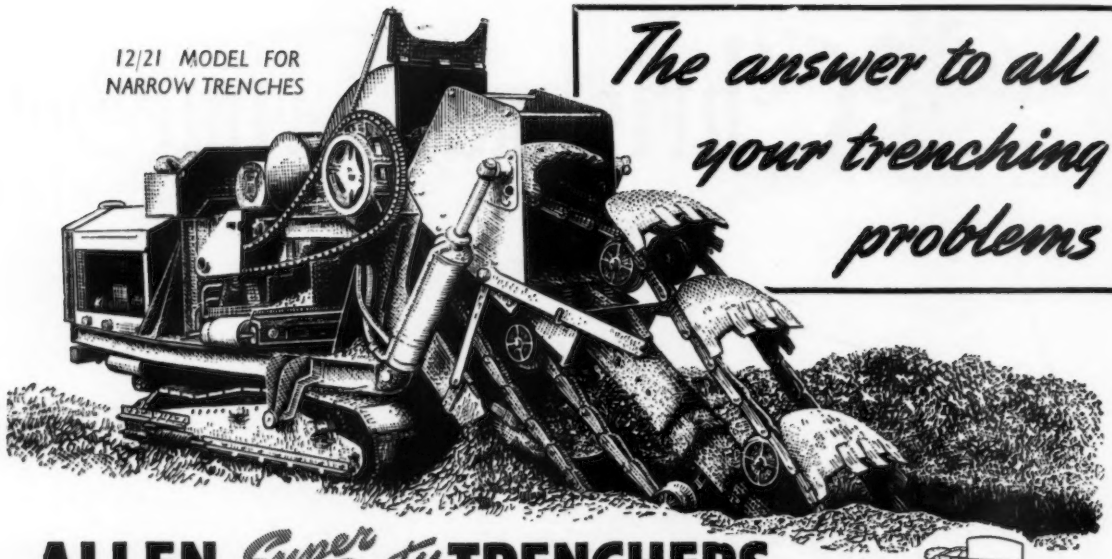

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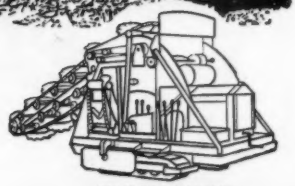

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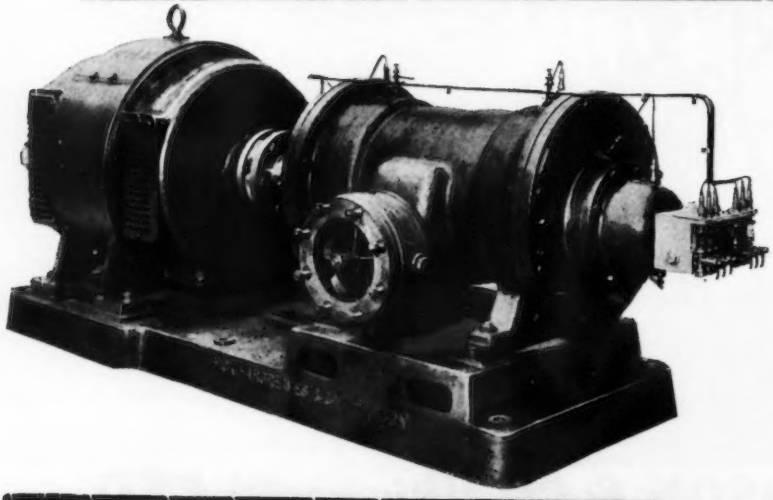

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The illustration shows an air-cooled Compressor for 15 p.s.i.g. Also available as a water-cooled machine for h.p. distribution.

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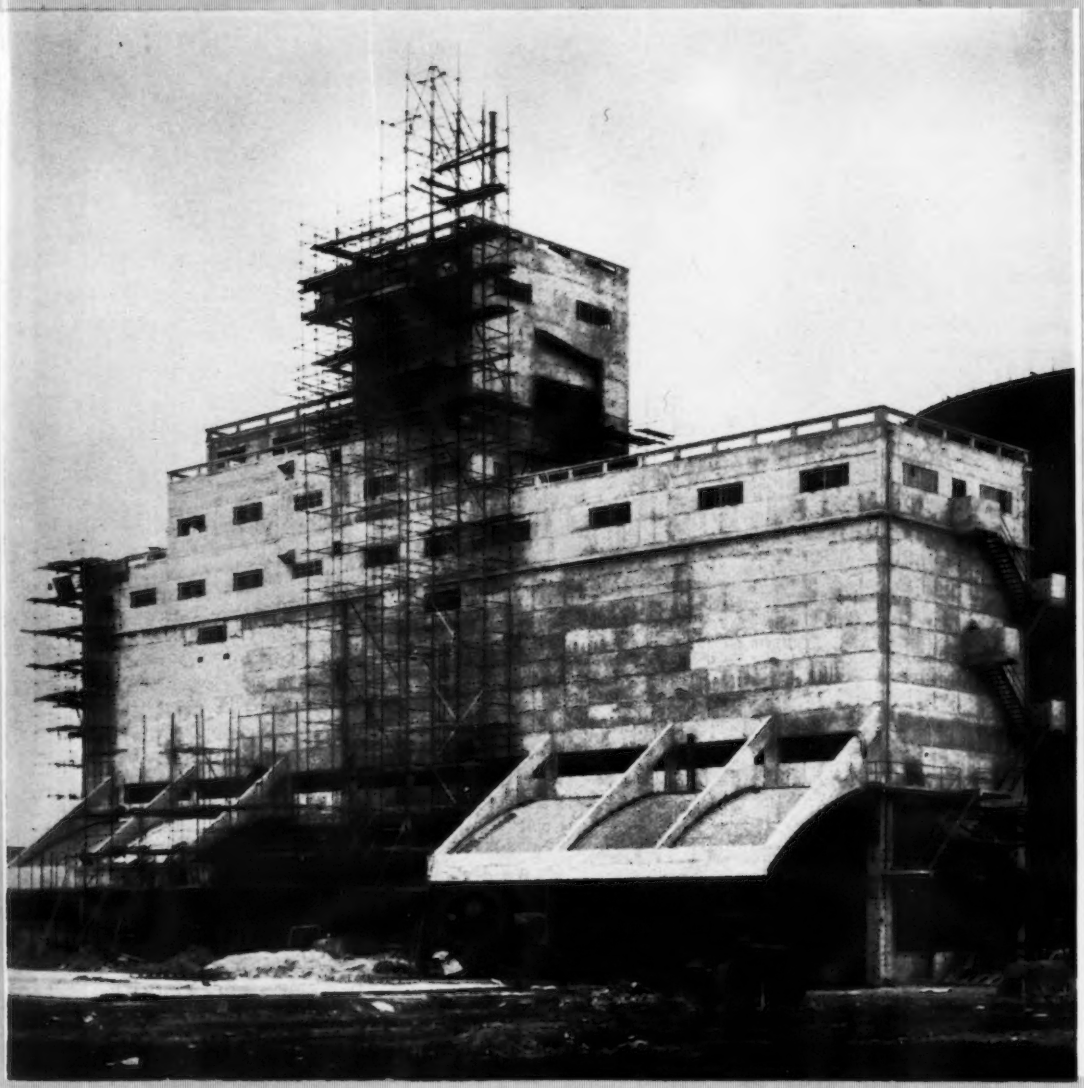

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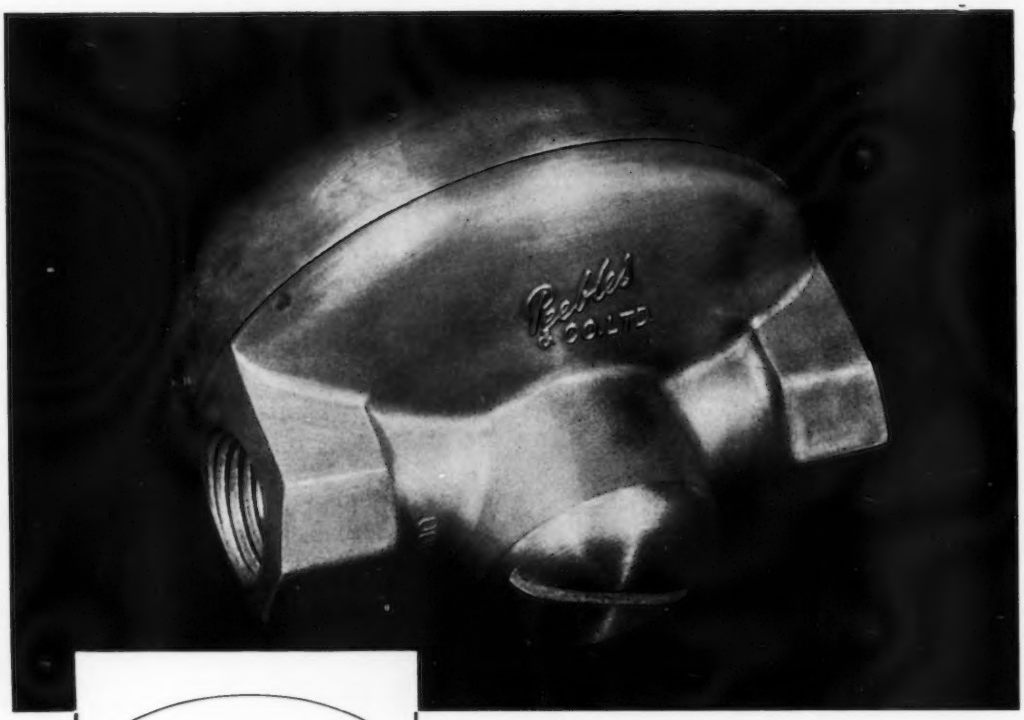

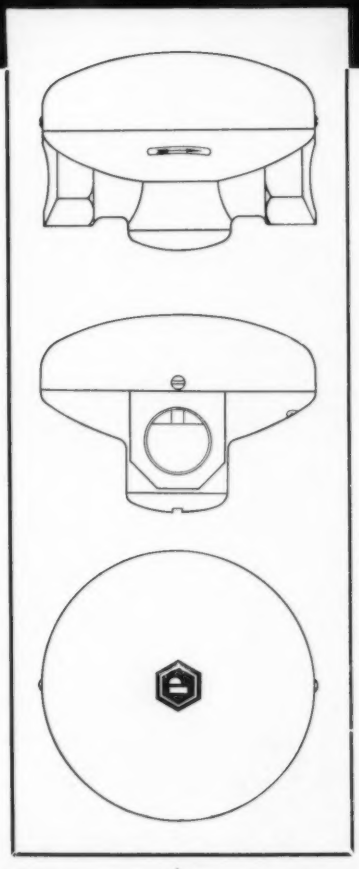

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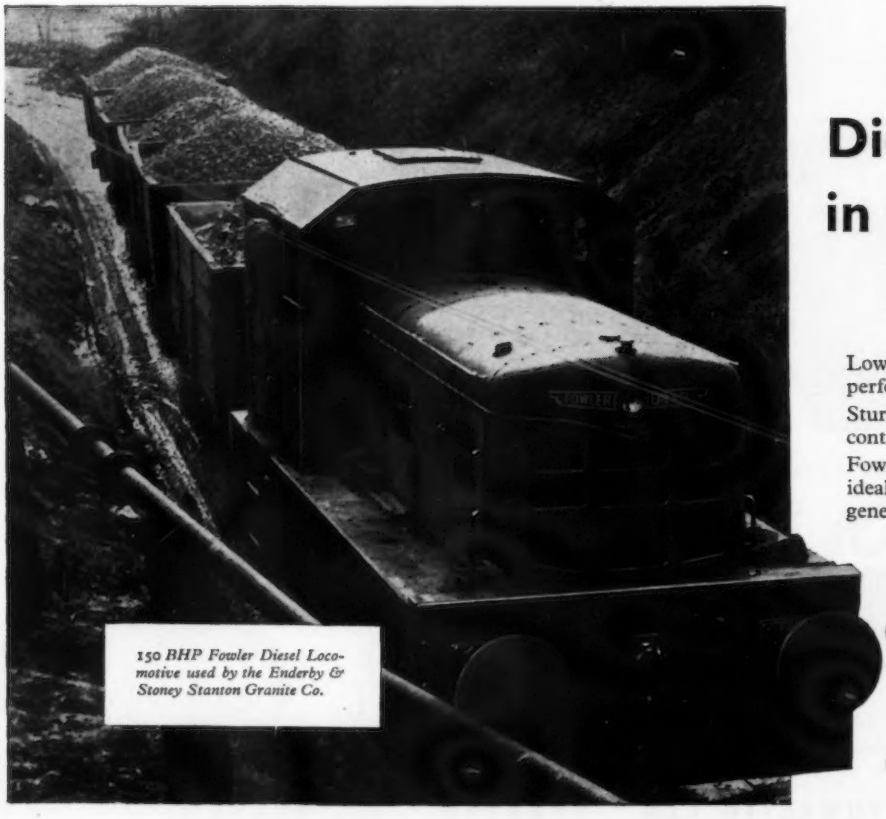

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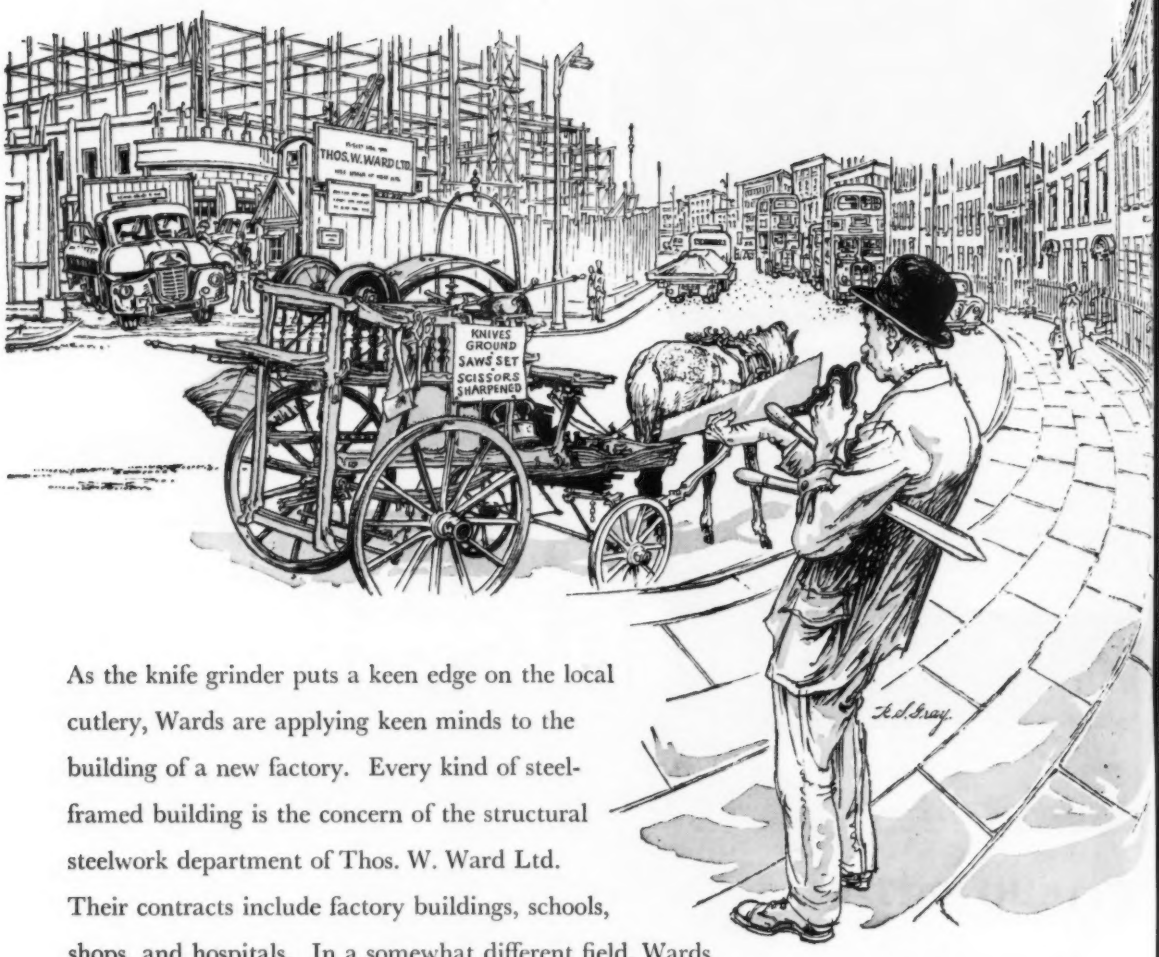

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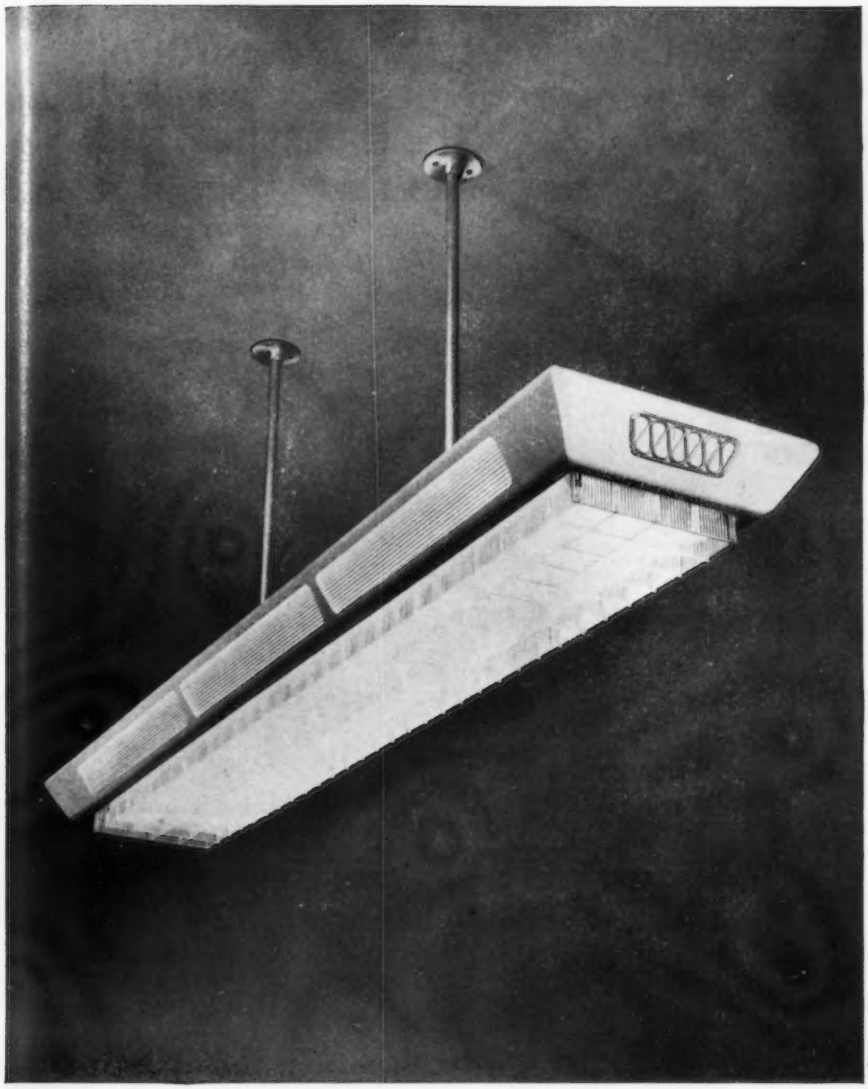

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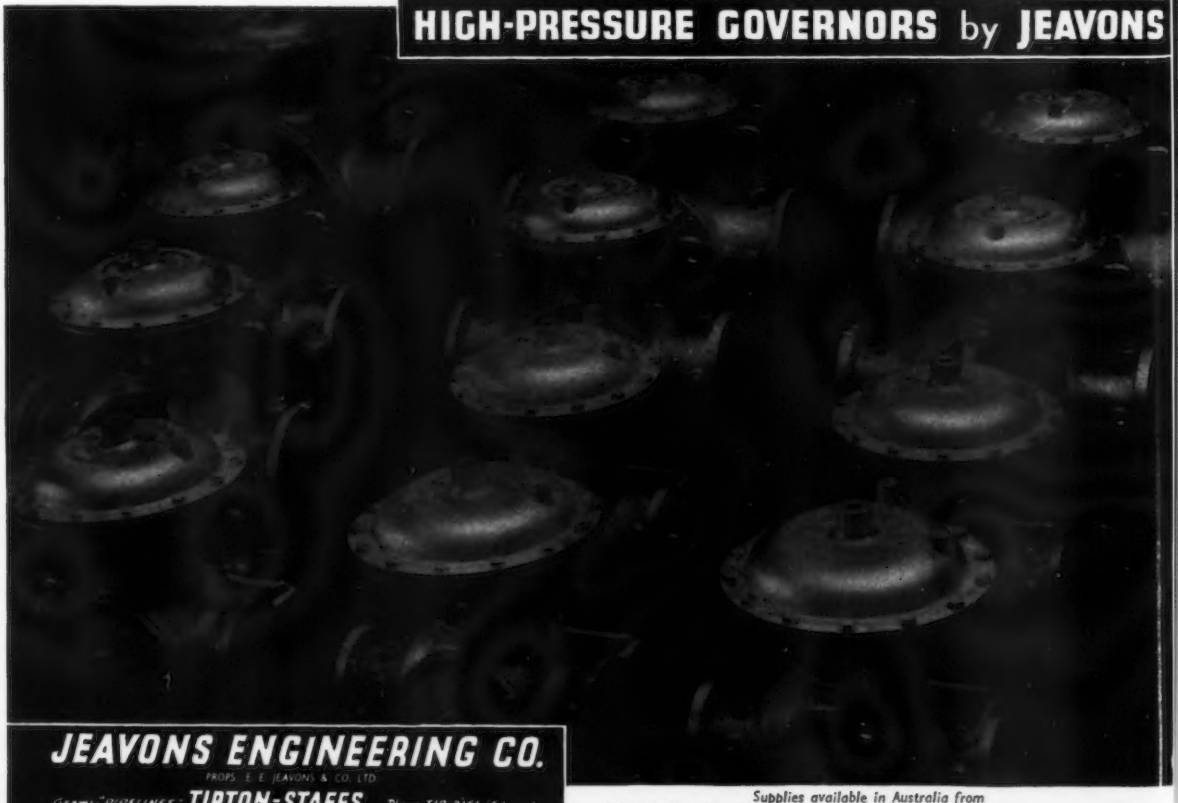

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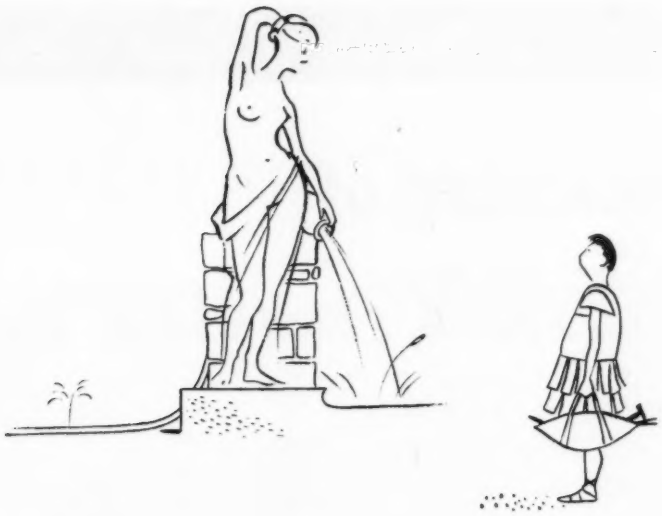

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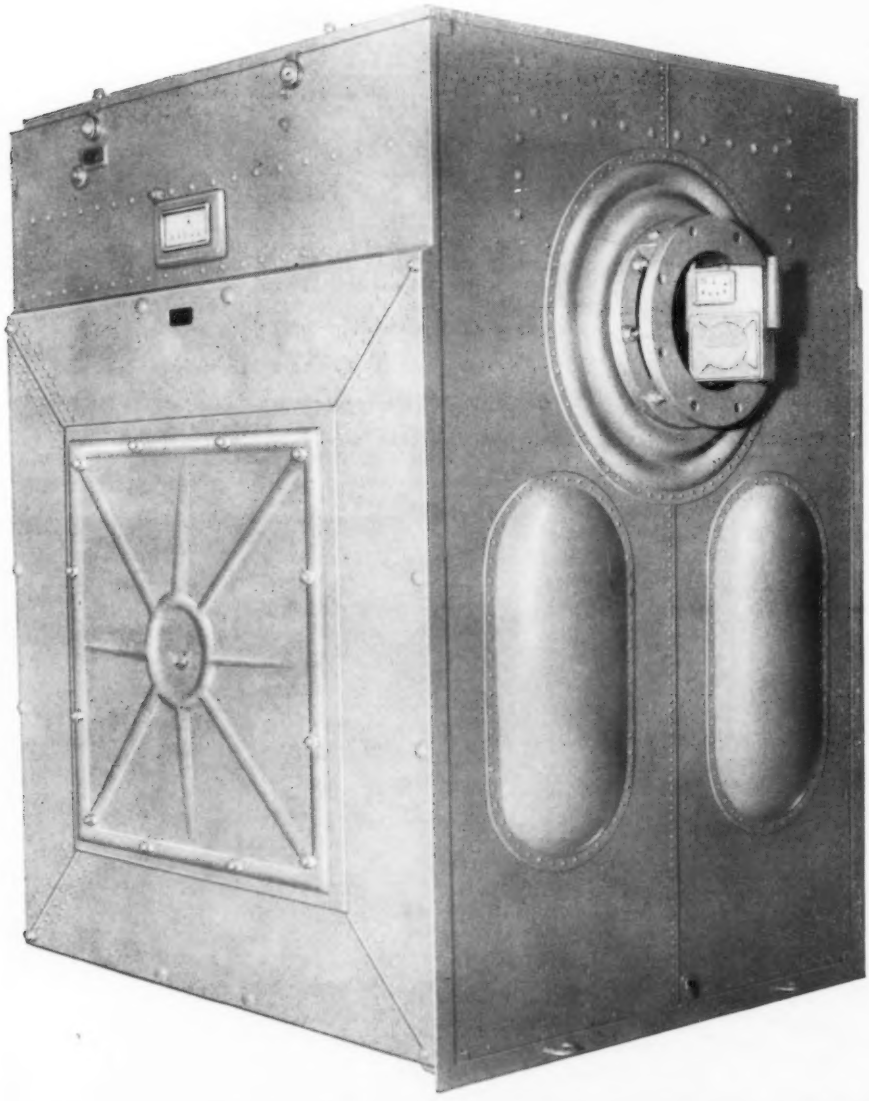

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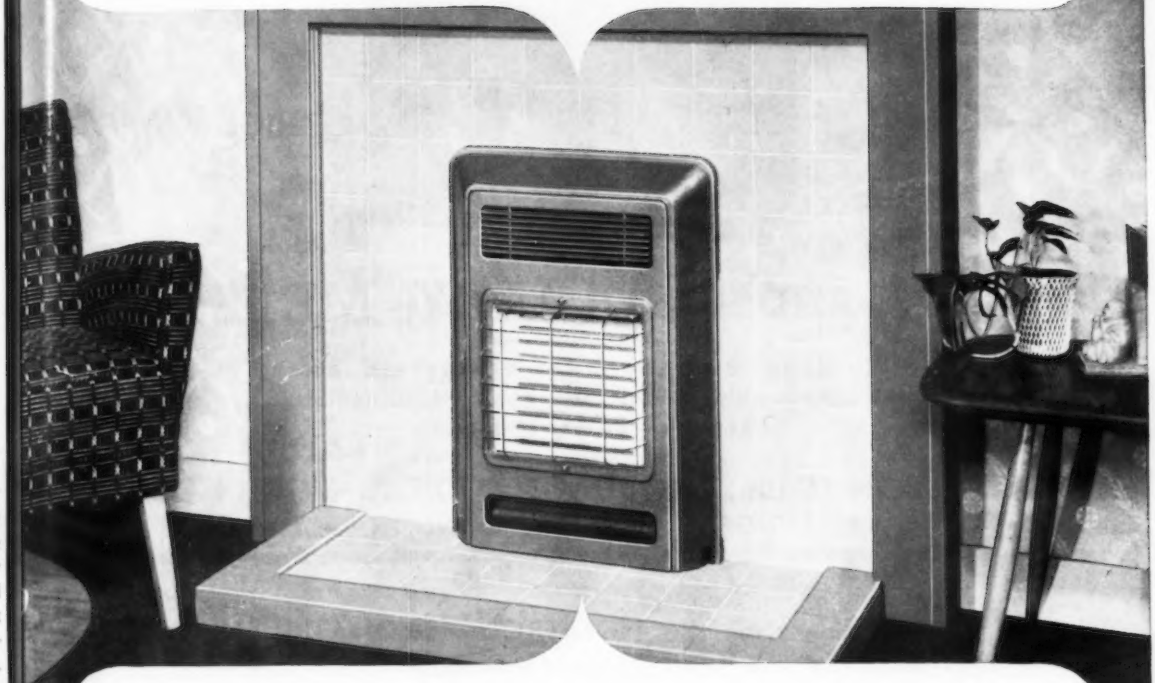

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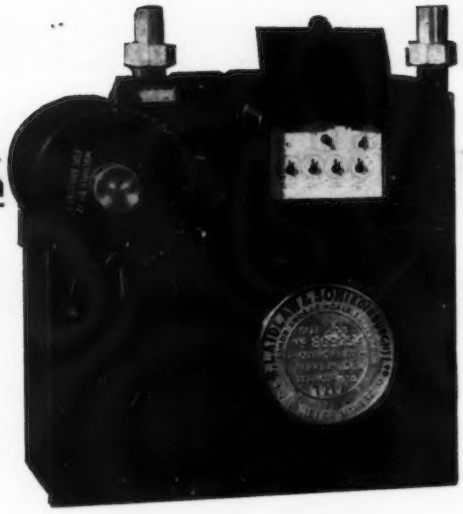

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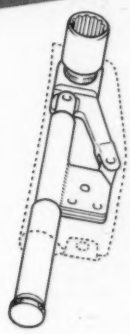

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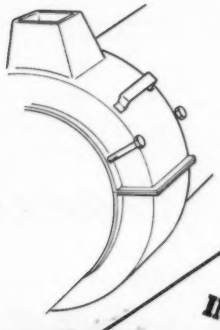

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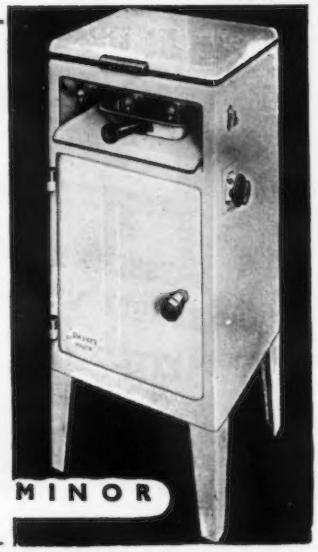
BIG Capacity for LITTLE Kitchens



Especially suited to the kitchens of flats and small houses, this highly efficient cooker provides utmost cooking capacity in the least possible space. Cast iron construction ensures strength and durability and reduces maintenance costs to a minimum, thus making the Dainty Minor particularly suitable for simple hire or hire purchase.

Approved and adopted by leading gas boards

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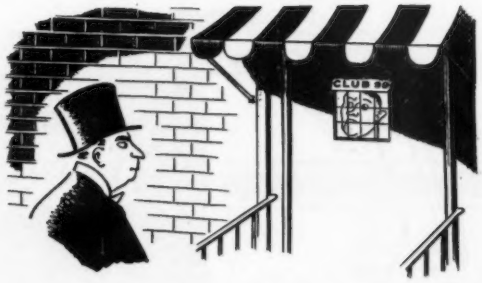

Wade Elbow Coupling copper to copper ⅛" O.D. to 1½" O.D.

Wade Straight Coupling copper to copper ⅛" O.D. to 1½" O.D.

What kind of a joint is this ?

Even although our illustration shows the more dubious kind of joint, there can be no doubt about joints made with Wade couplings.
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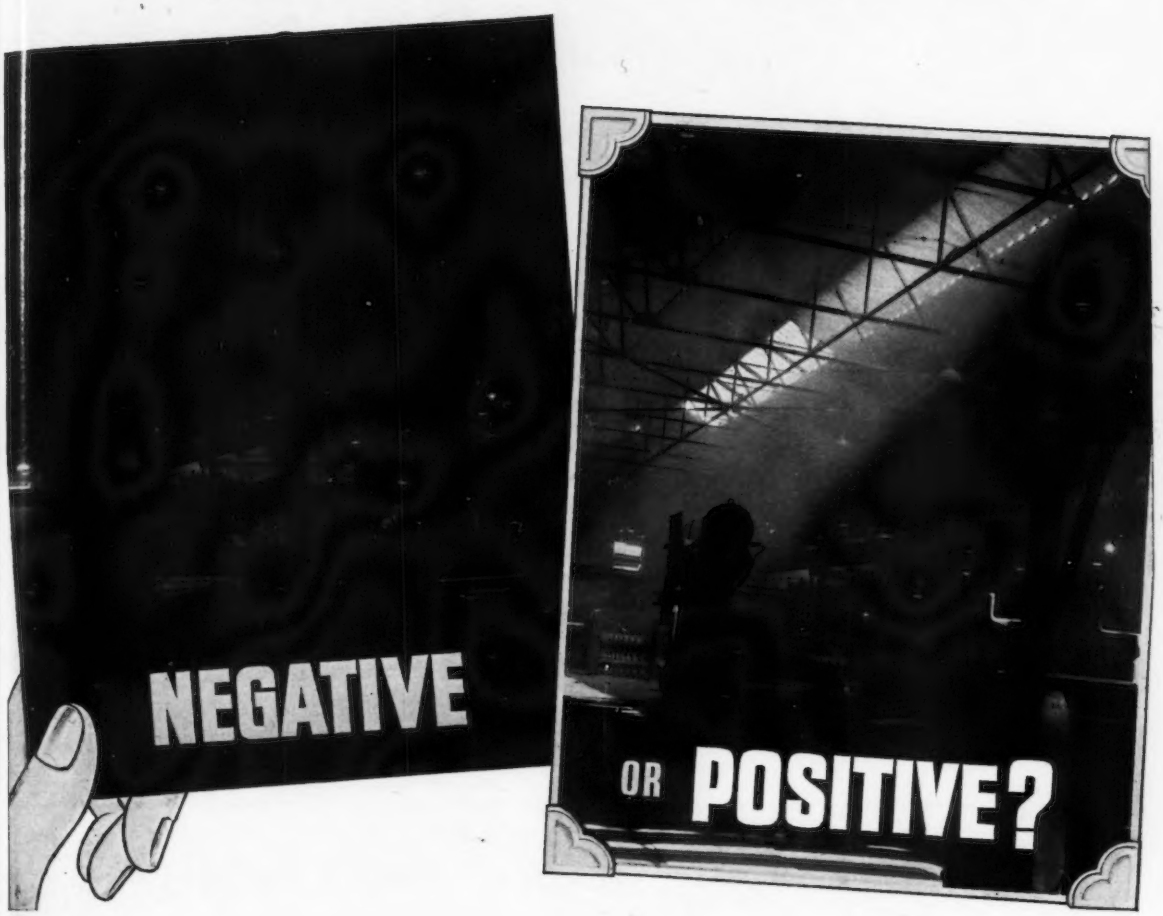

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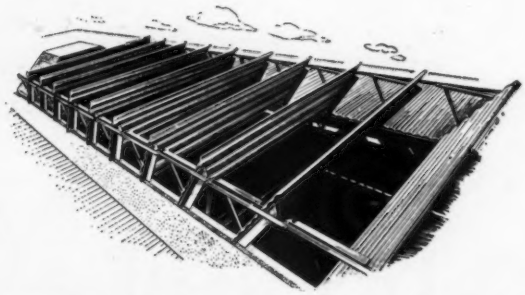

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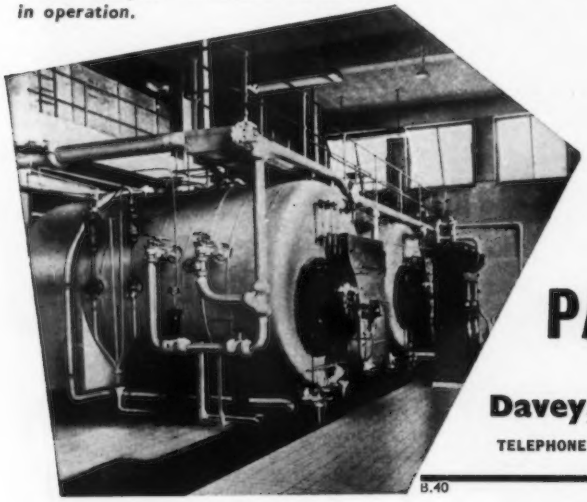

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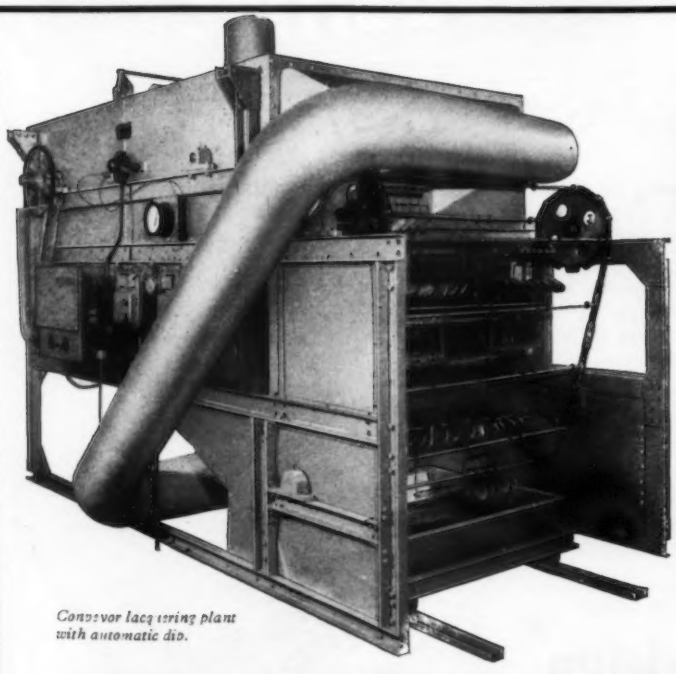

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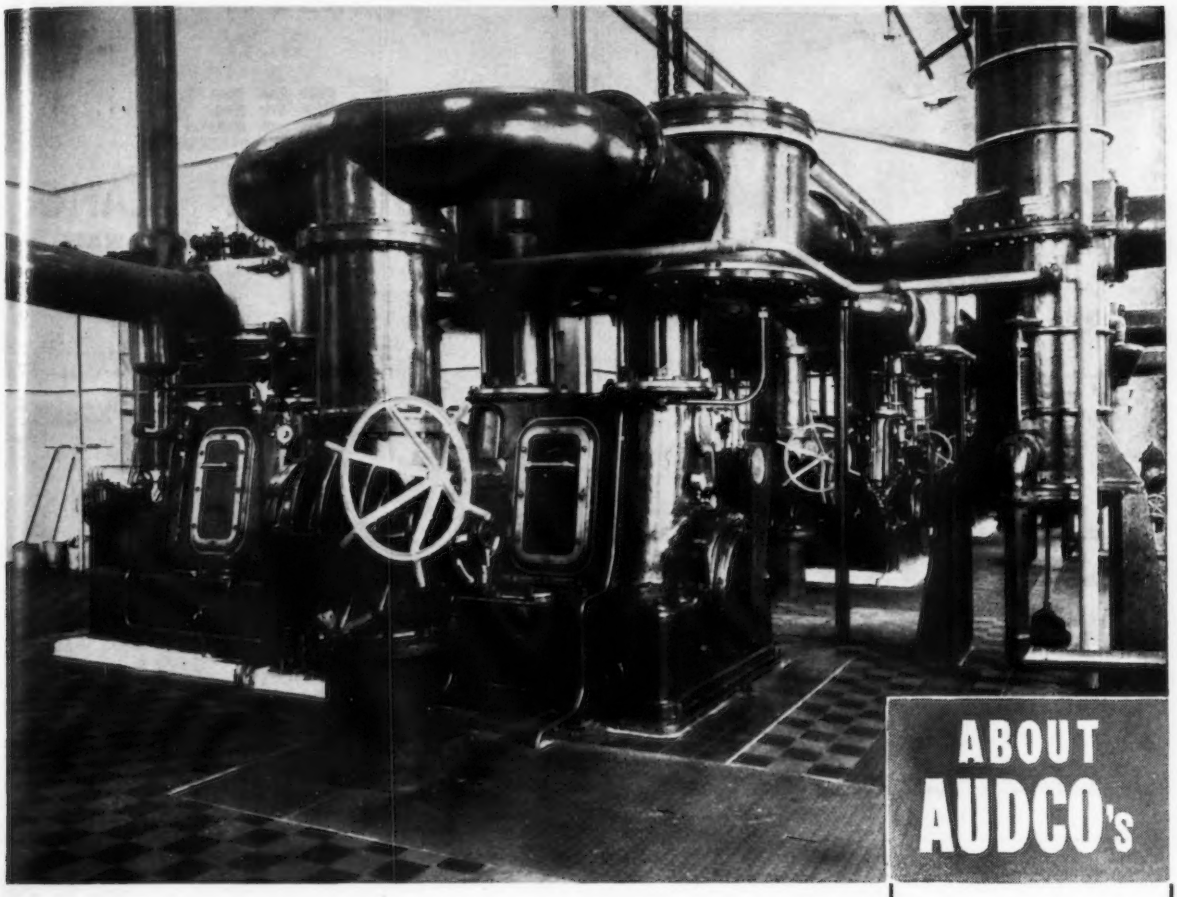

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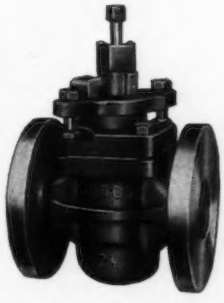

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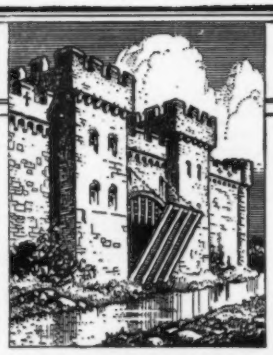

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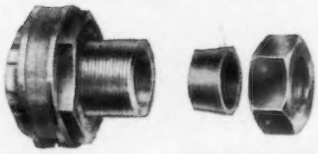

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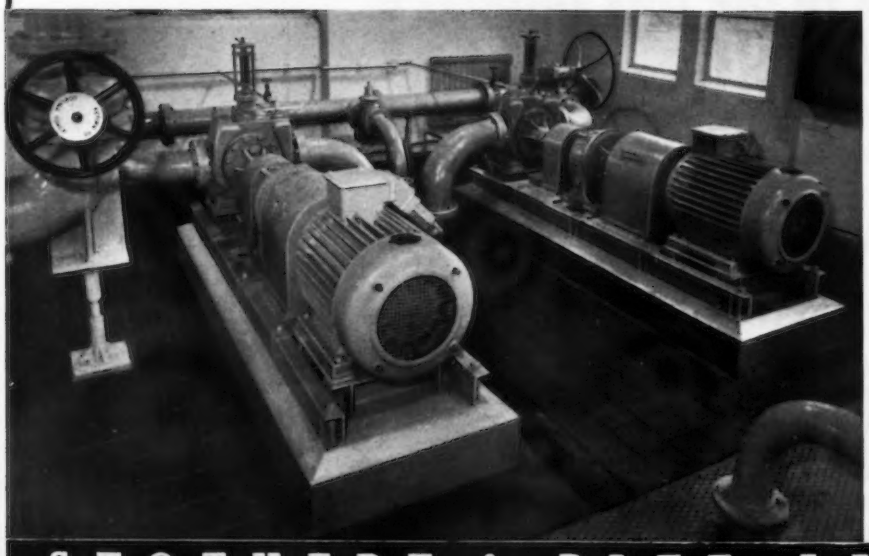

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These steam-jacketted rotary displacement pumps are lifting viscous tar from deep tanks. Each has a capacity of 10,000 gallons per hour, running at a speed of 360 r.p.m., against a discharge pressure of 50 lbs. per sq. inch.

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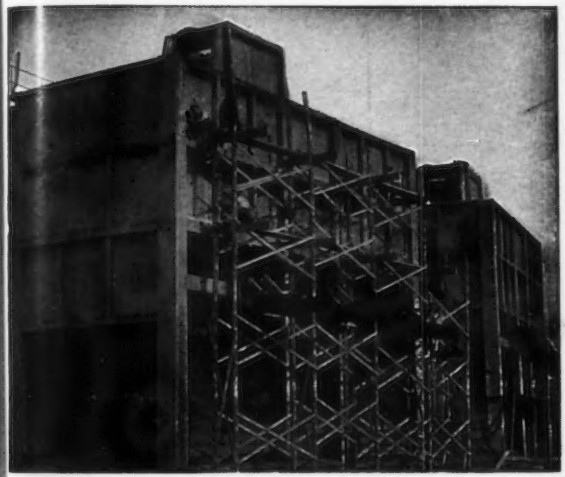

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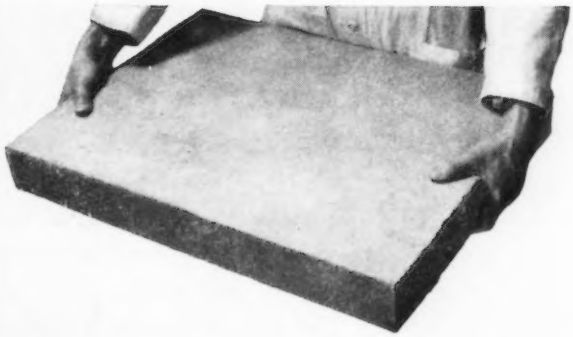

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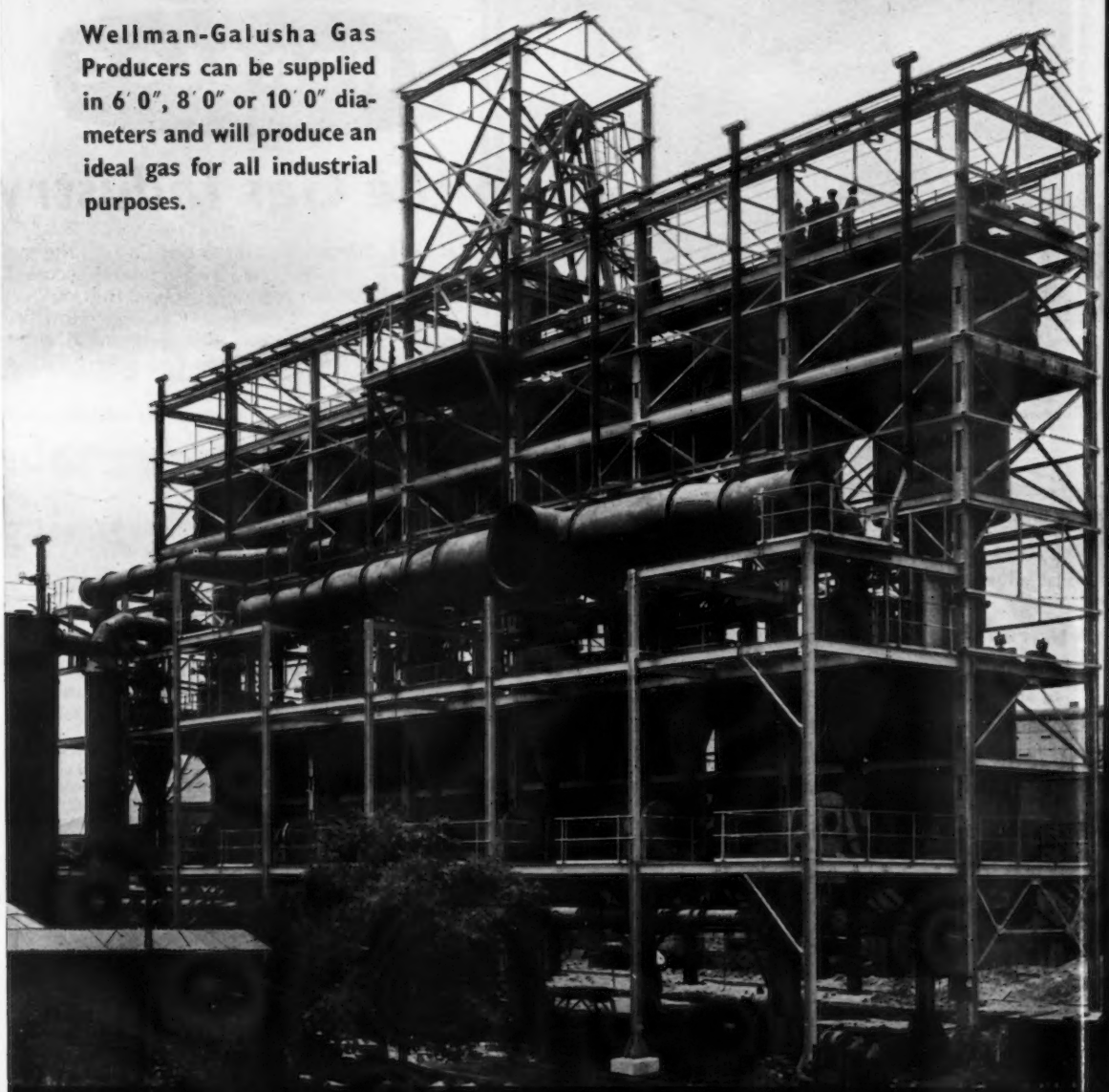

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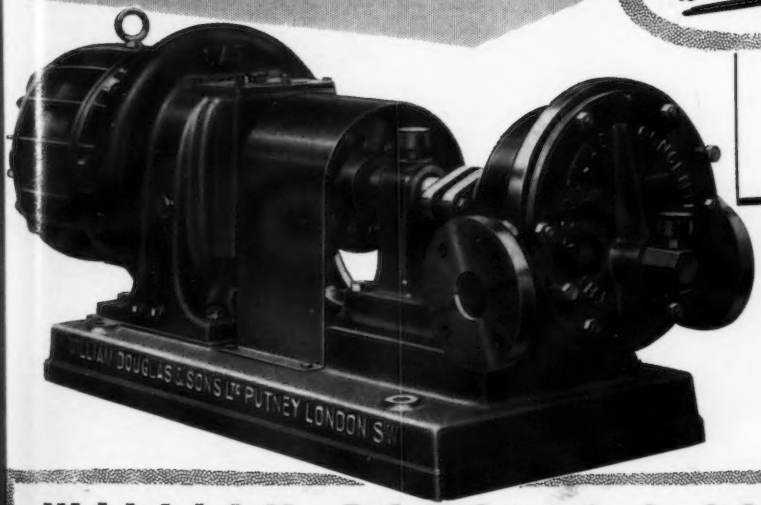

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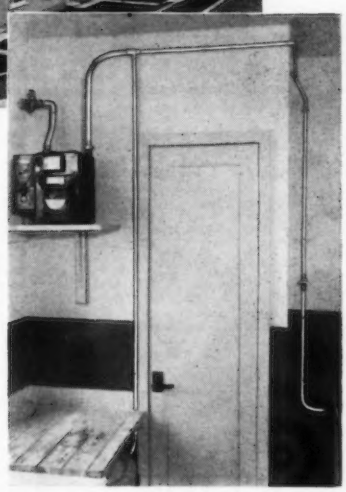

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INDEX TO 'JOURNAL' ADVERTISERS

A

C.E. Machinery, Ltd. ... ...
Abbott, Parks & Co., Ltd. ... ...
Acme Wringers, Ltd. ... ...
Aerogen Co., Ltd. ... ...
Aerograp Co., Ltd. ... ...
Arsonic Ltd. ... ...
Alder & Mackay, Ltd. ... ...
Aldridge & Ranken, Ltd. ... ...
Allan Taylor (Engineers), Ltd. ... ...
Allen, John, & Son (Oxford), Ltd. 686
Almal, Ltd. ... ...
Army Emergency Reserve ... ...
Ascot Gas Water Heaters, Ltd. ... ... Cover IV
Ascot Gas Water Heaters, Ltd. (F. A. Neat) ...
Ashmore Benson, Pease & Co. ... ...
Ashworth & Parker, Ltd. ... ...
Aspinall (Paints), Ltd. ... ...
Associated Lead Manufacturers, Ltd. ... ...
Associated Lead Manufacturers, Ltd. (Rustodian) ...
Atlas Preservative Co., Ltd. ... ...
Audley Engineering Co., Ltd. 703
Automatic Telephone & Electric Co., Ltd. ...
Automotive Products, Ltd. ... ...

B

Bale & Church, Ltd. 743
Balfour, Henry, & Co., Ltd. ... ...
Bayley, Thos., (Great Bridge), Ltd. ... ...
Bayworth Meters, Ltd. ... ... Facing p. 723
Beetham & Sons, Ltd. ... ...
Bentley Co., Ltd. ... ...
Bibby, Eli, Firth, Sons & Co., Ltd. 694
Booth, John, & Sons (Bolton), Ltd. ... ...
Brattt Colbran, Ltd. ... ...
Bray, George, & Co., Ltd. ... ...
Bray, W. E., & Co., Ltd. ... ...
British Carbo-Norit Union, Ltd. ... ...
British Gas Purifying Materials Co. ... ...
British Jeffrey-Diamond, Ltd. ... ...
British Oxygen Co., Ltd. ... ...
British Paints, Ltd. ... ...
British Rototherm Co., Ltd. ... ...
British Thermostat Co., Ltd. ... ...
British Thomson Houston, Ltd. ... ...
British Tyre & Rubber Co., Ltd. ... ...
British Vacuum Cleaner & Engineering Co., Ltd. ...
Broadbent, Thomas, & Sons, Ltd. ... ...
Broom & Wade, Ltd. ... ...
Brown, J., & Co., Ltd. ... ...
Bygden, Thos., & Co. ... ...

C

Cambridge Instrument Co., Ltd. ... ...
Cannon (G. A.), Ltd. ... ...
Cascade Water Coolers, Ltd. ... ...
Cathodic Corrosion Control, Ltd. ... ...
Cementation Co., Ltd. ... ... Cover II
Cinema-Television, Ltd. ... ...
Clapham Bros., Ltd. ... ...
Clayton, Son & Co., Ltd. ... ...
Clifford Engineering Co., Ltd. ... ...
Cochrane (Middlesbro') Foundry, Ltd. ... ...
Cohen, George, Sons & Co., Ltd. ... ...
Concrete Proofing Co., Ltd. 707
Consett Iron Co., Ltd. ... ...
Cort, Robert, & Son, Ltd. ... ...
Crane, Ltd. 684
Crone & Taylor, Ltd. ... ...
Crosby & Co., Ltd. ... ...
Crossley Bros. ... ...
Crowley Russell & Co., Ltd. 691
Curtis, A. L., & Co. ... ...
Cutler, Samuel, & Sons, Ltd. ... ...
Cuxson, Gerrard & Co., Ltd. ... ...

D

Davenport Engineering Co., Ltd. ... ...
Davey, Paxman & Co., Ltd. 702
Deb Chemical Proprietaries, Ltd. ... ...
De la Rue, Thomas, & Co., Ltd. (Gas Group) ...
Dempster, R. & J., Ltd. ... ...
Dempster, Robert, & Sons, Ltd. ... ...
Denison & Son, Ltd. ... ...
Derbyshire Silica Firebrick Co., Ltd. ... ...
Diaphragm & General Leather Co., Ltd. ...
Dick, R. & J., Ltd. ... ...
Donkin (The Bryan) Co., Ltd. ... ... Cover II
Douglas, Wm., & Sons, Ltd. 709
Drakes, Ltd. ... ...
Dresser Manufactures (England), Ltd. 699
Drew, H. B., Ltd. ... ...

E

E.B. Refractory Cement Co., Ltd. ... ...
Edgar, William, & Son, Ltd. ... ...
Econtrol, Ltd. ... ...
Electroflo Meters Co., Ltd. ... ...
Electrolux, Ltd. ... ...
Elliott Bros. (London), Ltd. ... ...
Elphinstone, Heap & Co., Ltd. ... ...
Enard, Ltd. ... ...
Essex Partners, Ltd. 704
Ether, Ltd. ... ...
Evered & Co., Ltd. ... ...
Ewart & Sons, Ltd. ... ...
Ewart Chainbelt Co., Ltd. ... ...

F

Falk, Stadelmann & Co. Ltd. ... ...
Fisher Governor Co., Ltd. ... ...
Flavell, S., & Co., Ltd. 730
Fluidrive Engineering Co., Ltd. ... ...
Fowler, John, & Co. (Leeds), Ltd. 690
Franki Compressed Pile Co., Ltd. ... ...
Franklin Furnace Co., Ltd. ... ...
Fry's Metal Foundries, Ltd' 675

G

Gas Purification, Ltd. 743
General Descaling Co., Ltd. ... ...
General Electric Co., Ltd. 693
General Gas Appliances, Ltd. ... ...
Gibbons Bros., Ltd. ... ...
Gibbons Heurtey, Ltd. ... ...
Glover, George, & Co., Ltd. ... ...
Glover, Thomas, & Co., Ltd. 714
Godfrey, Sir George, & Partners (Industrial), Ltd. ...
Goodall Clayton & Co., Ltd. ... ...
Grant, Lyon, & Co., Ltd. 746
Graphite Products, Ltd. ... ...
Green & Boulding, Ltd. ... ...

H

Hamilton, A. H., & Co., Ltd. 704
Hardman & Holden, Ltd. ... ...
Harris & Pearson, Ltd. ... ...
Harrisons (London), Ltd. ... ...
Hattersley & Davidson ... ...
Hawkins, W. T., & Co. ... ...
Hayward, E., & Co., Ltd. ... ...
Hick Hargreaves & Co., Ltd. 686
Hilmor, Ltd. ... ...
Hills (West Bromwich), Ltd. 701
Holmes, W. C., & Co., Ltd. ... ...Cover I, 745
Honeywell Brown, Ltd. ... ...
Hopkinsons, Ltd. ... ...
Horseley Bridge & Thomas Piggott, Ltd. ...
Horstmann Gear Co., Ltd. ... ...
Howden, James, & Co., Ltd. ... ...
Hudswell, Clark & Co., Ltd. ... ...
Humphreys & Glasgow, Ltd. 712
Hyde, Silas, Ltd. 702

I

Ideal Boilers & Radiators, Ltd. ... ...
I.C.I., Ltd. (Fyffes Fittings) ... ...
I.C.I., Ltd. (Metals Division) ... ...
Inertol, Ltd. ... ...
Infra Red Development Co., Ltd. ... ...
Ingham, John, & Sons, Ltd. ... ...

J

Jeavons, E. E., & Co., Ltd. 710
Jeavons Engineering Co. 694
Jenkins, W. J., & Co., Ltd. ... ...
Johnson, C. H., (Machinery), Ltd. ... ...

K

Keay, E. C. & J., Ltd. ... ...
Keelavite Rotary Pumps & Motors, Ltd. ...
Keith Blackman, Ltd. 746
Kier, J. L., & Co. Ltd. 687
Kings Patent Agency, Ltd. 743
King, Walter, Ltd. 743, 744
Kirk & Co. (Tubes), Ltd. ... ...
Kirkham Hulett & Chandler, Ltd. ... ...

L

Lafarge Aluminous Cement Co., Ltd. ... ...
Laidlaw, R., & Son (Edin.), Ltd. 698
Lamont, James H., & Co., Ltd. ... ...
Le Bas Tube Co., Ltd. ... ...
Leeds Fireclay Co., Ltd. ... ...
Lee, Howl & Co., Ltd. ... ...
Lindsay, Henry, Ltd. ... ...
Lionweld, Ltd. ... ...
Lind, Peter, Ltd. ... ...

M

MacLellan, George & Co., Ltd. ... ...
Macpherson, Donald, & Co., Ltd. ... ...
Magnetic Valve Co., Ltd. ... ...
Main, R. & A., Ltd. 738, 739
Mapel Metal & Pipeline Endurance, Ltd. ...
Matterson, Ltd. ... ...
Meltham Silica Fire Brick Co., Ltd. ... ...
Messengers & Sons (Birmingham) Ltd. ... ...
Meters, Ltd. ... ...
Metropolitan Vickers Electrical Co., Ltd. ...
Midland Iron & Hardware Co. (Cradley Heath), Ltd. ...
Milne (Edinburgh) Ltd. 740
Mint, Birmingham, Ltd. ... ...
Mitchell Engineering, Ltd. ... ...
Mitchell, H., & Co. ... ...
Monitor Engineering & Oil Appliances, Ltd. ... 698
Monk, A., & Co., Ltd. ... ...
Morley Products (Padiham) Ltd. ... ...
Mulberry Co. ... ...

N

National Benzole Co., Ltd. ... ...
National Cash Register Co., Ltd. ... ...
National Enamels, Ltd. ... ...
Newton Chambers & Co., Ltd. ... ...
Northern Manufacturing Co., Ltd. ... ...
Norwest Construction Co., Ltd. 683
Nu-Swift, Ltd. 743

O

Oxley Engineering Co., Ltd. ... ...

P

Parkinson & Cowan (Gas Meters), Ltd. 714
Parkinson Stove Co., Ltd. ... ...
Pass, E., & Co., Ltd. ... ...
Peart, E., & Co., Ltd. ... ...
Peebles & Co., Ltd. 688
Perl Controls, Ltd. ... ...
Plenty & Son, Ltd. ... ...
Power-Gas Corporation, Ltd. ... ...
Press, William, & Son, Ltd. ... ...
Pulsometer Engineering Co., Ltd. ... ...

R

Radiant Heating, Ltd. ... ...
Radiation, Ltd. 728, 729
Rawlplug Co., Ltd. ... ...
Reavell & Co., Ltd. 743
Ride & Bell, Ltd. ... ...
Riley, A. J., & Son, Ltd. ... ...
Roberts, R. E., & Sons, Ltd. ... ...
Robinson, J. H., & Co. (Liverpool), Ltd. ... 685
Royston, Geo., & Sons, Ltd. ... ...
Rozalex, Ltd. ... ...
Russell, R., & Sons, Ltd. 700

S

Salter, T. E., Ltd. ... ...
Sawyer, Geo. E., Ltd. ... ...
Senior Economisers, Ltd. ... ...
Siebe Gorman & Co., Ltd. 690
Sieber, Jas., Equipment Co., Ltd. ... ...
Siemens-Schuckert (Great Britain), Ltd. ...
Sigma Instrument Co., Ltd. ... ...
Silvertown Rubber Company Ltd ... ...
Simm, G. E. (Engineering) Ltd. 713
Simon-Carves, Ltd. ... ...
Simon, Richard, & Sons, Ltd. ... ...
Sisson, W., & Co., Ltd. ... ...
Smith Meters, Ltd. ... ...
Smith, Thos., & Sons (Rodley), Ltd. ... ...
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Stoves, Ltd. ... ...
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T

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Waller, George, & Sons, Ltd. ... ...
Walter King, Ltd. 743, 744
Ward, Thos. W., Ltd. 692
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Wellman Smith Owen Engineering Corpn., Ltd. 708
West's Gas Improvement Co., Ltd. ... Cover III
West's Piling & Construction Co. ... ...
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Whessoe, Ltd. ... ...
Whitley Moran & Co., Ltd. ... ...
Widnes Foundry and Engineering Co. Ltd. ...
Wilkes, A. H., & Co., Ltd. ... ...
Willey & Co., Ltd. 696
Williams, John E., Ltd. ... ...
Williamson, Cliff, Ltd. ... ...
Wilson, George, Gas Meters, Ltd. ... ...
Winn & Coales, Ltd. 706
Woodall-Duckham Construction Co., Ltd. facing p. 722
Wood, Hugh, & Co., Ltd. ... ...
Wormald Patent Locks Co., Ltd. ... ...

Y

Yorkshire Copper Works, Ltd. 709

Agencies ... ...
Appointments Vacant 743, 744
Appointments Wanted ... ...
Contracts Open ... ...
Educational ... ...
Fellowship ... ...
Miscellaneous ... ...
Patents 743
Plant For Sale And Wanted 744
Publications ... ...

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CONTENTS

EDITORIAL COMMENT

Report on Refractories .. 715
Natural Gas To Spare? .. 716
Successful Failures .. 716
Round Britain Minister .. 717
An Attitude of Mind .. 717

TECHNICAL RECORD

The Alnwick to Rothbury High Pressure Main. By W. R. Garrett and E. L. Robson .. 719
Institution of Gas Engineers Autumn Research Meeting:
46th Report of the Joint Refractories Committee .. 723
Explosion Reliefs for Ovens. By P. A. Cubbage and W. A. Simmonds .. 725
Operation and Control of Deep Purifiers At Ipswich. By W. Hayston and D. G. Wright .. 727

NEWS OF CURRENT EVENTS

Editor, 'GAS JOURNAL' .. 718
Personal .. 718
Diary .. 718
Wales and Mon. Juniors Visit Aberavon Works .. 734
Evening Classes .. 734
'New Homes For Old' Demonstration .. 734
Gas Council Film Library .. 735
Gas Consultative Councils .. 736
Long Service Presentations at Robert Dempster's .. 737
Company News .. 737
Simple Hire of Appliances .. 737
Gas Featured at Farming Shows .. 741
Refresher Courses for Engineers .. 741
Value of Gas to the Pottery Industry .. 792
Gas, Electricity, or Both? .. 742
Western Juniors Visit Bath .. 742
Gas Industry Statistics .. 742
Staggered Payments for Gas Accounts .. 742

PUBLISHERS' NOTICE, SEE PAGE 743

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Gas Journal

VOLUME 284. No. 4828. DECEMBER 14, 1955. 107th YEAR

Report on Refractories

THE four main topics discussed at the Autumn Research Meeting in the 46th Report of the Joint Refractories Committee: 1954-55 (*Comm. GC27*) were not very closely related. Pride of place was given to Mr. Laming's account of the further work he has done on 'Temperature surveys in continuous vertical retorts,' covering a period of some nine months' working, 'from the lighting of slow fires,' of one retort of each of the two principal designs in this country installed at London gasworks. Temperatures were recorded over four gasmaking periods in works No. 1 (Woodall-Duckham retorts) and six at works No. 2 (Glover-West retorts), each period being about 24 days. Thermocouples were inserted just inside the flue face and very near to the carbonizing face at three different levels in the two retorts in each installation. 'Since temperatures were automatically recorded simultaneously at 16 positions, the investigators, at the end of the survey, were faced with compressing into manageable proportions results recorded on some six miles of recorder trace—a remarkable achievement made possible by devising a special integrating machine to obtain the average daily temperatures. Specialists will be interested in the details of the thermocouples and their application to the job, and in many other details.

The fluctuations in temperature recorded at the carbonizing face, already observed in the earlier work, are of the greatest interest. These 'large daily fluctuations' are ascribed to 'the erratic descent of the charge.' One wonders whether, in the first place, this explanation is not too facile, and in the second, whether the fluctuations in these readings are of such significance as is implied in the Report.

Not enough account is taken in this connection of the probable—very probable—conditions which prevail in the retort in operation. In the first place the 'coke column' must not be regarded as fitting closely to the sides of the retort. The continuous taper is now recognized by all designers as the best practice. But the actual amount of taper is necessarily empirical; it must always be a little more than necessary to secure uninterrupted descent of the charge. There is thus a space between the coke column and the face of the retort, but this space is not always kept. The column will sway this way and that, and sometimes the hot coke is in contact with the retort wall and sometimes it lies an appreciable distance away. The space, then, will be of varying dimensions even at the same point. But, perhaps of more significance is the content of the space. It will be swept, irregularly, by volumes of coal gas coming from the cone of coal, by volumes of water gas and unconverted steam and, especially at the lower levels, by rushes of air from the bottom of the retort, giving rise to local combustion.

It is possible that these conditions alone are sufficient to account for fluctuations of temperature in the retort wall to the extent observed in these investigations. But no doubt there is erratic descent in the charge. Is this irregularity significant? After all, with most coke extractors the charge is lowered at appreciable, if frequent, intervals. It would seem that the inference is that as long as the daily throughput of the retort is constant, minor variations in charge-travel, as long as these are fairly even over the cross section, are of no great significance.

It would appear, too, that the thermocouple is very sensitive to variations in temperature. But is not the sensitiveness of this refined instrument out of proportion to the significance of its readings? In other words, will not the process tolerate considerable fluctuation of retort wall temperature without practical effect on the performance of the process?

The second topic of the Report, that of the iron spot, shows that this is brought, so far, to a satisfactory conclusion. Iron spots, at any rate up to a certain limit of size, are 'innocuous.' It is 'illogical to discard every silica shape that contains an iron spot.' Pending the full-scale trial adumbrated in the Report it might be well to agree, as Mr. Beale suggested, upon an upper limit of size which should be tolerated.

The third investigation, that concerned with the mechanical strength of silica bricks, reveals more accurately than has been hitherto suspected that a silica brick may be stronger at operating than at room temperatures. Silica products are indeed 'among the most complex of refractory materials.' It will take some time for the industry to digest these extremely interesting results.

And then we come to the refractoriness-under-load test. At first sight this would seem to be the most practical of tests to which refractory materials could be subjected. It is most disappointing that it is so difficult to obtain a satisfactory degree of reproducibility. This part of the Report and the discussion of it will be read with great interest. And here we may interject that

when this and other tests are perfected and agreed upon it is most desirable that they should be adhered to by purchasers and manufacturers alike, and that no other tests should be imposed or insisted upon involving the rejection of (practically) perfectly good materials.

Among other items in the Report perhaps the most interesting is the result of examination under the microscope of the crystalline structure of scurf. It seems to throw additional light on the theory of differential expansion as an explanation of flaking. The suggestion, put forward by Mr. Beale, that future temperature surveys should be extended to the interface of scurf and the retort wall during the scurfing period is another direction along which this problem might be attacked.

The remainder of the Report is of more academic interest but the whole indicates an encouraging milestone on the road to the attainment of a standard of refractory materials which will stand up to the exacting conditions of modern carbonizing plant.

NATURAL GAS TO SPARE?

ACCORDING to a recent report two major projects involving a total expenditure of nearly £15 mill. have just been put in hand at Cia Shell de Venezuela. Of these one estimated to cost £7½ mill. is for the construction of a 20 in. diameter gas pipeline running between the La Paz oilfield in the Maracaibo district of the State of Zulia and the Cardon Refinery on the Paraguana peninsular. Totalling 177 miles in length this pipeline will be able to carry up to 106 mill. cu.ft. gas daily. Delivery of the pipe will begin early next year and the line is expected to come into operation in 1957. The idea behind this scheme is that the gas shall be used as the principal fuel for the firing of the refinery's furnaces, thus liberating for potential markets the oil at present used for this purpose. Apparently the figure quoted for the amount of gas to be transferred from the oilfield to the refinery is based on the assumption that the whole of it will be used for the refinery's own requirements. At the oilfield, however, further substantial quantities of gas might become available and these could be piped to Cardon if a use could be found for them there. Which leads one to wonder whether there may not be here an ideal opportunity for the installation of a plant for the liquefaction of natural gas preliminary to its export by sea to this country. The Cardon Refinery is situated on the seashore and has jetty facilities for the shipment of refined oil products. Is it not possible that the same facilities might be used for loading tankers with liquefied natural gas?

Considerable interest has been aroused in the gas industry in this country by the suggestion that liquid methane might be imported, and the matter has been under active review for some time by a select team of gas engineers. So far, however, no official pronouncement has been made on the subject. No doubt there are many very real problems to be overcome, both technical and economic, before such a scheme can become a practical policy, but, in the meantime, the oil companies are pressing ahead with their projects of development overseas and some valuable opportunities for 'getting in on the ground floor' on natural gas transportation may be jeopardized. In the case cited the pipeline clearly has been designed to carry only that quantity of gas which the oil company itself requires at its refinery. If, by any chance, the gas industry in this country should decide to import liquid natural gas from the oilfields, openings such as these would be invaluable. Although the Venezuelan pipeline is not expected to come into operation until 1957 delivery of material to the site is to begin early next year. Consequently, in this case, there is probably little that can be done to increase the capacity of the main, even if it should be desired, except perhaps by the use of greater pressures. It is important to realize that pipelines of this length cannot be built in a short time and that if liquid natural gas, as a source of supply to the British gas industry, is to become a practical proposition close attention to the future plans of the oil industry is essential.

SUCCESSFUL FAILURES

DISCUSSION of technical papers sometimes takes unexpected turns. Recently Mr. M. E. Lee spoke to the London and Southern Juniors about the London Gas Regulations and in introducing his remarks he said that he did not expect much ensuing discussion as the subject was very much 'cut and dried.' As it turned out the discussion was long, lively, and well-opinionated. On the other hand, at the recent Autumn Research Meeting of the Institution of Gas Engineers, one of the papers presented was 'Area Technical Services,' by Mr. J. E. Davis, Chief Technical Officer, South Eastern Gas Board, and this was a subject that might have been expected to draw endless discussion. Added to that, the paper was circulated in anticipation to those members of the Institution attending the meeting so that they would have the opportunity of contributing their considered views. Thus it came as somewhat of a surprise when, after the prepared contributions, the President, Mr. W. K. Hutchison, invited further discussion from the floor. He said that he had hoped that the subject would provoke a greater flow of communication slips because he thought that every area board would have been willing to say whether they thought that their system was better, or perhaps worse, than that used by the South Eastern Gas Board. At least the exchange of information would have helped in the important task of getting scientific control, and with it the flow of research effort, back into the areas. The result of the President's appeal was some very invigorating extempore discussion that was, in many ways, more provocative of further thought than the previous contribution. The first of these speakers was Mr. K. W. Francombe, of Whessoe Ltd., who commented on section VII of the paper which dealt with the recruitment of staff for the type of job which the author had described. He said that everywhere people were wanting and advertising for university graduates with the best possible qualifications and the best possible brains for recruitment to their staffs, but that they were quite unsuccessful in obtaining enough of these high-level people. Rather by accident, this had led, in the case of his own company, to dilution with people of less ability, on the very good principle that if you had a good man, well qualified and highly trained, he would probably be able to carry with him a couple of other men of much less ability. This had resulted in his finding a very good source of people for jobs at this level, a category not widely known, namely university undergraduates who had failed in the course of their training at the university. These people had come through a good deal of preliminary selection to get to the university at all; they had passed the necessary examinations to obtain higher level certificates and had been sufficiently good to be chosen for a place at a university, and may have done two or even three years at the university before being weeded out. They were usually excellent men who had lacked the aptitude for passing the second- or third-year examinations. Unfortunately, so far as he knew, these people were not listed by the university appointments officers, and they were not on the Central Scientific Register. Indeed, perhaps the only place to find them was on the lists of personnel available at the local labour exchange.

Mr. Francombe has certainly made an important point, one with which we are inclined to agree. The country is

desperately short of technologists in all fields, and yet there are many young men who are compelled to enter into entirely different professions from those dictated by their university training, simply because they have failed their final examinations and have thus forfeited any recommendation from their universities. The subsequent training of these men is often more practical, by force of circumstances, than that of more academically-minded graduates. As a result, given the opportunities, they can often prove to be of more ultimate value to the engineering professions. We would recommend that all employers should seriously consider this source of recruitment for, if no encouragement is given to these failed-degree men, and they are not allowed the right opportunities to prove their abilities, it will be the nation at large that will suffer.

ROUND BRITAIN MINISTER

THE Minister of Fuel and Power, Mr. Geoffrey Lloyd, is certainly sparing no effort in his 'Save Fuel' campaign. He and his Parliamentary Secretary, Mr. L. W. Joynson-Hicks, are touring the country on behalf of the Government and imploring all industrialists to economize in coal consumption. Their speeches, given in Birmingham, Liverpool, Edinburgh, Nottingham, Cardiff, and other cities throughout the country, differ only in exposition and the few details that are apposite to the particular area in which each speech is delivered. It is the aim of the Government to obtain a reduction of 10% in industrial coal consumption, or a saving of 2 mill. tons of coal during the winter months. Mr. Lloyd has expressed his hope that every industrialist will make a determined individual contribution to this national coal economy target and will do some hard thinking about the future. A point that Mr. Lloyd has stressed, particularly in Lancashire, which is the home of a major portion of our exporting industries, is that the cost of importing coal, half of which is American, into Britain will be £80 mill. in foreign exchange. 'That,' he said, 'is an additional sum that will have to be paid for by the increased efforts of our own exporting industries.' He said that every ton of coal saved meant £7 on the credit side of the balance of payments, and every ton wasted meant a weight added to the wrong side of the scales, thus widening the gap which already existed between Britain's exports and imports. Even Ministers of the Crown may be observed to mix their metaphors on occasions! Mr. Lloyd did not believe that any industrialist deliberately wasted coal but he said that if every managing director took a more personal interest in his company's coal consumption, he could find ways and means of making immediate savings in steam raising and space heating. More often than not it could be done with little or no capital expenditure. Coupled with the speech-making tour is an extensive advertising campaign in the quality national dailies. In quarter page notices the Ministry recommends that managing directors should seek the assistance of the National Industrial Fuel Efficiency Service for heat and power problems. N.I.F.E.S. suggests that for immediate savings space heating systems, which consume half of industry's winter fuel, should be checked; maintenance of boilers, transmission lines, and all process plant should be checked; and there must be certainty that all boiler operators are trained, as untrained men can waste the 10% that has to be saved.

For long-term economy, Mr. Lloyd asks all those who have a freedom of choice of fuel to turn over to a fuel more readily available than coal. The one he most mentions in his speeches is oil. He says that it often pays a company now to switch over to oil, which both helps the company and relieves the pressure of demand on the coal industry. For this purpose a firm which wants to make big savings but has difficulty in finding the capital investment at the present time, there is the Government's fuel efficiency loan scheme under which loans are made on very favourable terms. He cites gas and electricity as examples of industries that are switching over to oil. These, we believe, are rather unfair examples, for they are both fuel industries, consuming fuel and supplying fuel and always directly concerned with its economic utilization. For the smaller company, which has fuel costs that are only a small proportion of overall costs and which is therefore little concerned with fuel economy, it would be easier and cheaper to turn to gas rather than to oil, with a similar improvement in control and economy over coal consumption. The N.I.F.E.S. should be aware of this and in its service to concerns which seek its advice it should recommend the use of gas. In this respect Mr. Lloyd should remember that the great oil companies employ staffs to publicize their products and he would be doing a greater service to the nation if he were to recommend the use of a nationalised fuel that is both refined and capable of efficient application.

AN ATTITUDE OF MIND

'VIEWPOINT,' in the November edition of *Thermfare*, seems to be the result of some rather confused thinking. The article begins by decrying Press and political criticism of the nationalised industries for their lack of social responsibility with resulting time and labour wastage; it also takes exception to the fact that people are encouraged by the Press to send their gas service complaints to the newspapers rather than to the responsible authorities. Perhaps the public are mistrustful of the authorities' sense of responsibility, as indicated by the considerable criticism, and so trustful of the 'Power of the Press' that they can think of no other direction for their complaints! 'Viewpoint' continues that, despite this climate of criticism and what it calls the low-level rates of pay in the gas industry, there is a hard core of men in the industry who stick to their work because they are devoted to it. Or could it be because they are devoted to the security and ultimate pension which a nationalised industry can offer? Reverting again to 'social responsibility' in the gas industry, 'Viewpoint' tells us, in effect, that the members of the area boards are political appointees rather than gas employees, for if they were employees they would be more interested, personally, in making a success of the industry's policies. Looking through the lists of area board members we find that although some board members have been drawn from outside the industry, the majority of them are engineers or men qualified in some other aspects of the gas industry, *all* full or part-time servants, many of whom have gained their positions after years of promotion from the lowlier levels. If only union officials throughout the country would stop this incitement to grumbling for a while, and, instead, pass on to their members some little encouragement to higher productivity and greater enthusiasm, then there might be less criticism of the nationalised industries from the public and a stronger case for the wage claims of those industries.

Perhaps naturally, owing to their public ownership, the nationalised industries are regarded by people and Press as fair game for criticism. For this reason employees of these industries need to exercise more than usual care in the way they represent their industry, particularly when in contact with the general public. However, once the fact is acknowledged that nothing is likely to prevent the criticism of public bodies by their owners and that, in many cases, criticism is just a case of 'letting off steam' about some particular complaint, and is not a complete condemnation of everyone and everything in that industry, then a more philosophical attitude of mind is possible.

EDITOR, 'GAS JOURNAL'

The Directors of Walter King, Ltd., announce that Mr. Trevor G. Williams, A.M.I.MECH.E., ASSOC.INST.GAS E., M.INST.F., will in the near future be relinquishing the Editorship of the 'GAS JOURNAL'.

They further announce, with great pleasure, that Mr. Geoffrey W. Battison will be appointed in his place. This will not incur any change in the conduct of 'GAS SERVICE and Domestic Coke', which Mr. Battison has edited with conspicuous success for the past seven years. It is considered that his assignment to both papers, to be complemented by the appointment of a Technical Editor, will streamline the Company's organization and assure a live and up-to-date service of news and technical information for all in the industry.

Mr. Geoffrey W. Battison

Mr. Arthur Cross will continue as Deputy Editor. His many friends will be glad to learn that he is making excellent progress after a serious operation in October.

Personal Notes

We announced last week that DR. HAROLD HARTLEY, C.B.E., the Chairman of Radiation, Ltd., will, at his own request, relinquish the office of Chairman at December 31, 1955, and that his successor will be the present Deputy Chairman, Mr. W. Donald King, M.INST.GAS E. Dr. Hartley will retain his directorship of the Company.

Dr. Hartley succeeded to the Chairmanship upon the retirement of Mr. J. F. Davies on December 31, 1949. He is a Past President of the Institution of Gas Engineers and of the British Cast Iron Research Association. From 1938 to 1945 he was Chairman of the Council of the Cast Iron Research Association, and he has been a member of the Council of the Gas Research Board since its inception. Born in the Isle of Man, Dr. Hartley was educated there and at Manchester Grammar School and Manchester University. Studying under the late Professor H. B. Dixon, he won First-Class Honours in Chemistry in 1907, and took the degree of D.Sc. in 1919. A Woodiwiss Exhibitioner and Gartside Scholar of the University, he travelled in Norway and Canada during 1908-9, studying power production for electrochemical industries. During part of the

time in Canada he did research work at McGill University, Montreal, and from 1909 to 1912 was Gas Research Fellow at Leeds University. Dr. Hartley entered the domestic appliance industry in 1912 when appointed Chief Chemist to Richmonds Gas Stove Co., Ltd., Warrington. On the formation of Radiation, Ltd., in 1919, he became head of the Research Department, and has been executive head of the Central Research Laboratories since their foundation in 1920. Following the transfer to Birmingham in 1939, Dr. Hartley was elected a member of the Board of Directors and appointed Technical Director.

MR. W. D. KING was trained as an engineer at Vickers, Ltd., Barrow-in-Furness, and joined the Richmonds Gas Stove Company in London in the early

days of Radiation, Ltd., being appointed Sales Manager in 1933 and Sales Director in 1939. In 1943 he became General Manager of Richmonds and Fletcher Russell Warrington Works, and in 1946 Managing Director of these Companies. He was appointed Chairman of these Companies in 1948. In 1950 Mr. King was elected Chairman of Wilsons and Mathiesons, Leeds, and was appointed a Director of Radiation, Ltd., in 1944. In 1953, on relinquishing his duties in charge of the production of the Northern Group of Radiation Companies, he was appointed Deputy Chairman and Technical Director of Radiation, Ltd.

MR. M. A. GRIFFITH-JONES, has been appointed Sales Manager of W. H. Dean & Son, Ltd. Mr. Griffith-Jones,

(*Concluded at foot of col. 3*)

who is 38, joined the Gas Light and Coke Company as a staff pupil in 1936. After serving in the war on the Staff of a British Military Mission he rejoined the Gas Light and Coke Company under the Staff Controller and was later on the Commercial Manager's personal staff. After nationalisation he became responsible for commercial matters on the Northern Division of North Thames Gas Board, and later, shortly before joining W. H. Dean & Son, of the Board's Central Division. He was called to the Bar in 1953.

MR. LESLIE HARDERN, Public Relations Officer of the North Thames Gas Board, has been elected Chairman of the Council of the Institute of Public Relations.

Diary

December 15.—MANCHESTER JUNIORS: Short papers in competition for the F. Johnston Prize. Gas Showrooms, Manchester.

December 15.—INSTITUTE OF FUEL, MERSEYSIDE SUB-SECTION: 'Instrumentation of Boilers,' R. Clare, Liverpool Engineering Society, 9, The Temple, Dale Street, Liverpool. 7 p.m.

December 16.—WALES G.C.C.: The Castle, Shrewsbury. 2.15 p.m.

December 20.—LONDON AND SOUTHERN I.G.E.: 'Some Thoughts on Industrial Relations,' P. Valon Bennett, Junior Institution, Pepys House, 14, Rochester Row, London, S.W.1. 2.40 p.m.

December 29.—NORTH THAMES G.C.C.: Westminster City Hall, Charing Cross Road, W.C.2. Includes visit to Research Centre at Fulham. 2.30 p.m.

January 3.—EAST MIDLANDS G.C.C.: Victoria Station Hotel, Nottingham. 11.30 a.m.

January 4.—INSTITUTE OF FUEL, LONDON: 'Coal Research Problems and their Industrial Implications,' R. L. Brown. Institution of Civil Engineers, Great George Street, S.W.1. 5 p.m.

January 6.—LONDON AND SOUTHERN JUNIORS: 'Next Slide, Please!'—an aid to the presentation of technical papers, R. N. Le Fevre, 178-180, Edgware Road, London, W.2. 6.30 p.m.

January 7.—SCOTTISH JUNIORS (EASTERN): Short Paper day. Dundee. Works Visit optional.

January 9.—INSTITUTE OF FUEL, NORTH EASTERN SECTION: Four short papers: Case Histories, by the National Industrial Fuel Efficiency Service, Chemistry Lecture Theatre, King's College, Newcastle - upon - Tyne. 6.30 p.m.

January 10. — MIDLAND JUNIORS: 'Distribution of Gas in Birmingham,' R. W. Nelson.

January 11.—SOUTH WESTERN I.G.E.: 'Coal and its Treatment,' Dr. Idris Jones, C.B.E. Bristol.

January 13.—SCOTTISH JUNIORS (WESTERN): Short paper evening. Papers by C. M. Miller and R. Taylor. Gas Showrooms, 522, Sauchiehall Street, Glasgow, C.2. 6 p.m.

Welding gang on central third of route over moorland country. (Route may be seen disappearing over far hilltop.)

The Alnwick to Rothbury High Pressure Main*

By W. R. GARRETT, A.M.I.C.E., M.Inst.Gas E.† and E. L. ROBSON, B.Sc., Assoc.M.Inst.Gas E.§

As far back as 1945 the present Chairman of the Northern Gas Board, who was then the General Manager and Engineer of the Newcastle & Gateshead Gas Company, proposed to the Board of Directors the possibility of giving a supply of gas to Rothbury from Morpeth by means of a flexible copper pipe conveying gas at high pressure. The idea was to have large coils of ¾ in. or 1 in. bore copper pipe—similar to the 'Pluto' pipeline which carried petrol from England to France during the war—and to mole plough this into the ground. It was thought, at that date, to use a working pressure of 300 to 350 lb. per sq. in., but with the resumption of the scheme in June, 1953, and bearing in mind the large increase which had taken place in the price of copper between 1945 and 1953, it was decided to use 1½ in. bore mild steel pipe at 100 lb. per sq. in. working pressure.

Routes Considered

Four possible routes to Rothbury were considered for the main:—

(a) Morpeth via Longhorseley and Weldon Bridge: distance 15.7 miles.
(b) Morpeth via L.N.E. Railway line: distance 22 miles.
(c) Shillbottle via Newton on the Moor and Longframlington: distance 12.3 miles.
(d) Alnwick via Alnwick Moor: distance 12.0 miles.

The ultimate choice was route (d) because of the enlargement, mechanization and modernization of Alnwick works which was already in hand, and the shorter distances involved (see photo above). An additional advantage was ample scope for any additional coke produced at Alnwick.

Material for Main

Copper, plastic, and steel tubing were considered for the project, but the final choice was 1½ in. bore 8 w.g. thick $1\frac{29}{32}$ in. O.D. in 16/23 ft. random lengths E.R.W. tube protected on the outside with a bituminous solution, followed by a 'security' coating of glass tissue wrapping. For internal protection red lead paint was adopted. There was no doubt regarding the need to weld the joints as opposed to screwing, but in view of the desirability of having a smooth internal bore, a butt joint was not favoured. However, on approaching the tube manufacturers they agreed to produce a 1½ in. bore long sleeve joint to similar dimensions as that supplied for their then smallest standard of a 2 in. long sleeve joint, *i.e.*, 2 in. depth of sleeve. For protection of the joints bitumen was considered but the loss of time necessitated by firing a boiler with oil or coke together with transport problems, *etc.*, was not attractive and the final choice was a woven glass fibre ribbon 3 in. wide impregnated with a corrosion-inhibiting plastic preparation.

Copper tubing 15, 17 and 18 gauge was under consideration, but even by adopting the lightest gauge the pipeline would have cost nearly half as much again as steel. The proposal was to use half hard quality 1.612 in. O.D. at 0.91 lb. per ft. in 18 to 20 ft. straight lengths, although it was ascertained

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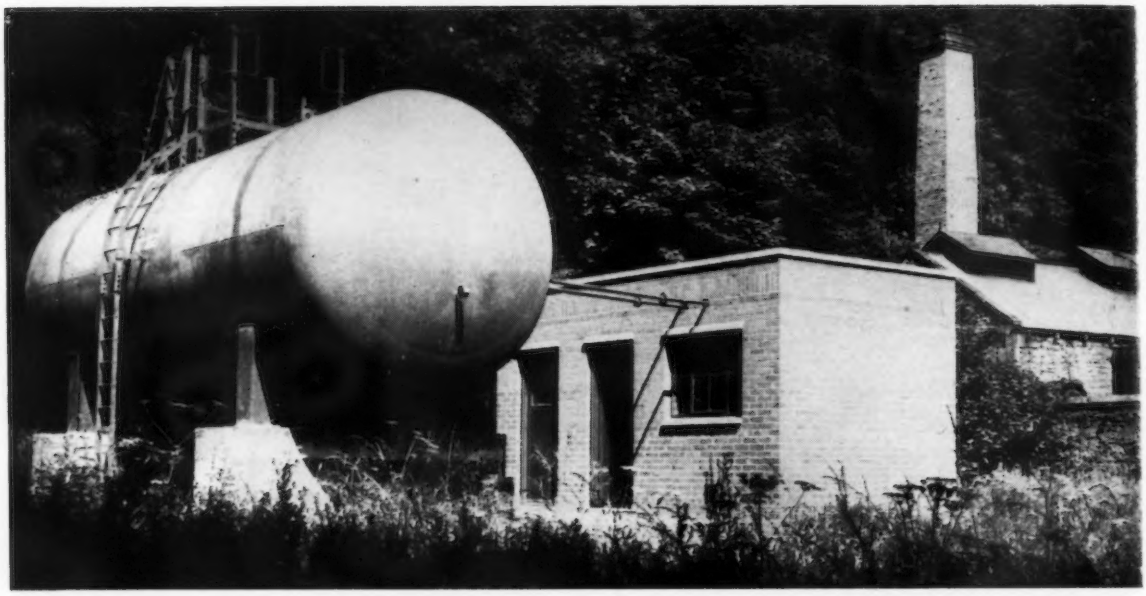

Fig. 1. H.P. receiver and generator house at Rothbury with old retort house on right.

that coils up to 60 ft. maximum length were available. For jointing it was proposed to use 'Yorkshire' straight sweated joints and 'Conex Terna' couplings at 300 ft. intervals.

Doubts whether polythene would remain firm when in contact with towns gas combined with the fact that its estimated cost of installation would be nearly double that of steel ruled out this material. In the estimate it had been assumed that 100 ft. long coils 1.93 O.D. at 0.465 lb. per ft. would be used and the jointing would be by means of 'instantor' type compression couplings with a copper tube insert. Other plastic materials were considered such as cellulose acetate and unplasticised P.V.C., but generally it was felt that lack of experience in their use and high initial cost would not offer any advantage over polythene.

Compressors at Alnwick

Two single cylinder, single stage, double acting, vertical, enclosed compressors each of 3,000 cu.ft. per hour have been provided for compressing the gas, and provision has been made for an additional machine. These, when running at 500 r.p.m., absorb 12.8 H.P. and provide a delivery pressure of 100 lb. per sq. in. The cylinder bore is 6¼ in. diameter and the piston stroke is 4½ in. One machine is driven through Vee-rope by a 14 H.P. slip-ring motor and the other through a similar drive by a 16 B.H.P. two-cylinder vertical diesel engine. In the case of the diesel engine a hand-operated clutch is provided to facilitate starting the engine. The electric motor and engine are housed separately from the compressors and the drives are taken through a wall box fitted with sealing glands. Each machine is fitted with vertical aftercoolers, and water for these and the compressors is taken from one of the works gasholder tanks and is returned to an adjacent holder tank and this in turn overflows to the first tank. A Klaxon hooter gives audible warning when the pressure reaches 100 lb. per sq. in. or falls below a predetermined amount. In the case of the electrically-driven compressor a Budenburg pressure gauge switch stops or starts the motor of the compressor at selected pressures.

Storage Vessel at Rothbury

This is an all-welded vessel 9 ft. in diameter by 21 ft. long on the straight supported on two cradles. (Fig. 1.) The shell is $\frac{7}{16}$ in. thick with dished ends $\frac{11}{16}$ in. thick. The vessel was X-rayed, stress relieved and hydraulically tested to 135 lb. per sq. in. The design pressure is 90 lb. per sq. in. with a normal working pressure of 50 to 80 lb. per sq. in. and normal volume of 1,500 cu.ft. Two 18 in. diameter manholes, two 1 in. drains and two 1½ in. pressure connections have been provided in addition to a 2 in. safety valve. An external ladder and platform gives access to the top manhole and safety valve.

Operation of System

Although compression of natural gas to very high pressures has been carried out in the United States, the Alnwick to Rothbury supply, as far as is known, is the first in this country where coal gas is being pumped at 100 lb. per sq. in. pressure. It carries, therefore, a certain amount of novelty, not only with regard to the pressure but also in that the receiver is at such a distance from the point of compression. The free volume of the 12 miles of 1½ in. diameter main is approximately half the free volume of the receiver and, therefore, plays a large part in the storage of gas.

The system normally operates as follows: Starting with a full receiver, gas is bled off to the Rothbury district through the L.P. governors, and the pressure in the receiver and pipeline gradually falls. This fall in pressure becomes apparent at the Alnwick end, but always lagging in time due to friction in the length of pipe. When the pressure at Alnwick reaches a predetermined low figure the compressor starts pumping gas into the line and the pressure in the receiver again begins to increase. The time lag now operates in the reverse direction and when the pressure at Alnwick reaches 100 lb. per sq. in. and the compressor stops, the pressure at the Rothbury receiver is approximately 90 lb. per sq. in. It will be realized that the difference of pressure and time lag effects between the compressors and receiver are variable depending upon the district demands, and this affects the upper and lower limits for stopping and starting the compressors.

Consideration was given to installing a pressure gauge at Alnwick that would record the pressure in the Rothbury receiver, and at the time of laying the main the simultaneous laying of a suitable electrical link was considered. Consideration was also given to transmitting the pressure readings over the G.P.O. lines in a manner similar to that in use from Elswick to Annitsford. However, the cost of both schemes was high for the information which would be gained and as it was known that the pressure drop would be a maximum of some 40 lb. per sq. in. and that after a few preliminary tests it would be possible to arrive at the best upper and lower pressures for running the Alnwick compressors, it was decided to omit a long distance pressure indicating line. Standard pressure recorders at both ends of the pipeline have been installed.

Gas from the H.P. receiver passes to the district through either of two main governors which breaks the pressure down from a maximum of 90 lb. per sq. in. and provides, by means

of clock controlled pilot governors, one of three suitable district pressures.

Construction Work

Work on the pipeline commenced on September 14, 1954, and continued six days per week until December 11, a total of 77 working days, during which 12 miles of pipe were laid. The working party consisted of the excavation gang averaging five in number over the period, the welding gangs of two welders and two mates, and the mainlaying gang comprising a foreman and six men. The construction of the pipeline comprised several series of operations shown diagramatically in Fig 2. Many of these operations were proceeding at the same time and could be classified as follows:—

(1) Excavation of trench.
(2) Laying out of pipes along trench side from piles along the route.
(3) Welding of pipes into composite lengths.
(4) Laying out of battens over trench.
(5) Lifting of composite lengths on to battens and welding over trench.
(6) Testing of pipe.
(7) Wrapping of pipe and lowering into trench.
(8) 'Snaking' of pipe in base of trench.
(9) Backfilling of trench.

Excavation of Trench

The excavation was carried out in definite stages, each man doing one specific part of the work each day. Firstly, the turf was removed, then followed first spit depth, trimming of sides, second spit depth, cleaning base of trench and trimming to correct depth and width. With a gang of five men digging in good ground, up to 350 yds. of trench 1 ft. 9 in. deep by 9 in. wide could be excavated per day, *i.e.*, 70 yds. excavation per man day. Working weekends, the gang actually dug and backfilled 12 miles of trench in 81 days, *i.e.*, an average of 52 yds. excavation and backfill per man day. A daily record of yardage excavated was kept and agreed each week with the foreman. Payment was made fortnightly.

Laying Out of Pipes

Two men from the mainlaying gang were detailed, as required, to go ahead of the welders and lay sufficient pipes out along the route to ensure sufficient work for the welders on the following day. They were provided with a light pneumatic-tyred tubular steel truck on which approximately 10 lengths of pipe could be handled at one time. The pipe heaps, where possible, were placed on high points along the route with a sufficient number of pipes for laying out down the slopes in each direction to meet up with the next stock pile. This assistance from gravity was of great benefit to the men, both easing the work and reducing the time required for this operation.

Welding of Pipes into Composite Lengths

The two welding gangs consisted each of one welder and mate. Apart from looking after the welding machines the mates laid out battens on the road side, one batten per pipe length of 22 ft. 6 in., sufficient to weld 10 lengths of the pipe together to form a standard 75 yds. composite length. They also cleaned the socket of each pipe free of red lead paint, knocked the pipe home into the socket of the preceding pipe and assisted the welder by turning the length round on the battens so that he could run a downhand weld all round the socket. Each socket was given two welding runs. The first weld was deep into the angle and the second on top to form the final fillet. Vodex No. 12 electrodes were used averaging 2½ electrodes per joint. Working an eight-hour day the two welders were capable of welding 70 lengths of pipe per day, *i.e.*, seven composite lengths, including the average number of seven final oxy-welds over the trench.

Testing of Pipe

The day's quota of composite lengths having been welded *in situ*, testing of that section could then take place. The forward open spigot end was sealed off with a short piece of blank-ended pipe and an 'Ermeto Coupling.' The air compressor, coupled up to the nearest manhole point back along the route, was then started up and pumping continued until a pressure of approximately 180 lb. per sq. in. registered on the manhole gauge. The compressor was stopped, the manhole valves shut and the main under test isolated, then a soap test on every joint was immediately carried out. If a leak was found it was marked, the air released from the pipe, the welder called back and the joint made good.

Leaks seldom occurred and it can be recorded that after the first day no leak occurred on an electric welded joint and only four on oxy-acetylene joints. Trouble with the electric welded joints on the first day was due to the red lead in the sockets now being scraped out. This began to boil when heated and caused blow holes in the electric weld. As already mentioned, one of the duties of the welder's mate from then on was to clean all sockets before welding. The leaks which occurred in the oxy-welds were very minute and always under the pipe where welding was most awkward.

Wrapping of Pipe and Lowering into Trench

The morning after the test the test pressure was recorded. A drop of 1 to 3 lb. per sq. in. from 180 to 179 to 177 lb. per sq. in. was a usual figure, this being mostly due to temperature drop. Because of the soap test on each joint the previous night, any serious drop in pressure was first looked for and always found at a manhole cock which was allowing air to pass into the back line and which, after greasing, proved airtight on the next test.

Three men were usually detailed to wrap the tested section as soon as work started in the morning. Not only was each joint wrapped, but every foot of the pipe was inspected for damage to the protective covering, and all faults were attended to. When the wrapping was completed the same three men, by using rope slings, eased up the pipe, removed the battens one at a time and gently lowered the pipe into the trench.

One rather important factor limited the amount of pipe

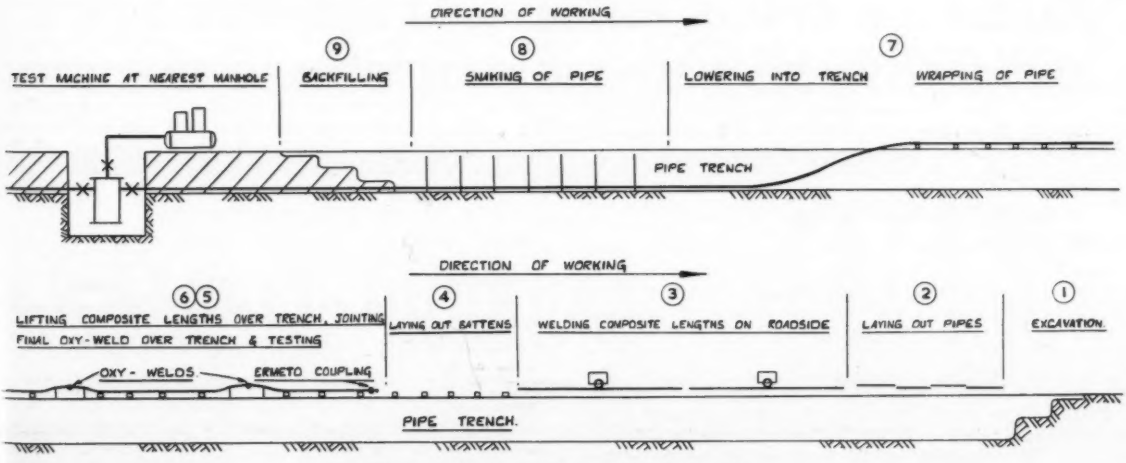

Fig. 2. Diagrammatic outline of operations

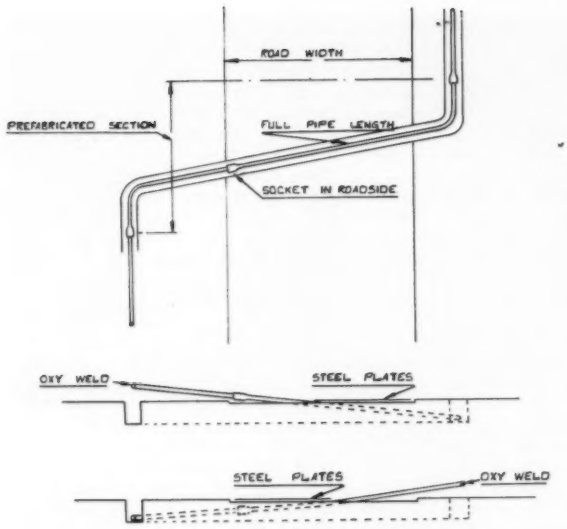

Fig. 3. Road crossing procedure.

which could be lowered each day. With the pipe supported on battens, a certain amount of sagging took place and naturally the length of pipe on the battens was greater than that required when in the trench base. When lowering commenced, this extra length became more and more apparent as an awkward loop which had to be treated with the greatest respect due to the potential whipping action which could take place during handling. It was found, particularly on a long straight run, that 100 lengths of pipe were about the maximum which could be lowered before this loop became unmanageable.

Snaking of Pipe in Trench

A fall in ground temperature of 20°F. during winter would cause a pipe contraction of 12 in. in 1½ miles. Although the natural bends in parts of the route would take account of any such contraction it was considered a wise precaution, especially where the pipe took a long straight run, to 'snake' the pipe in the base of the trench and so enable it to contract without placing undue tension on the cast-iron plug cocks each side of the dust traps which were the most vulnerable places for tension fracture.

The pipe was eased over to alternate sides of the trench near each pipe joint and stakes approximately 2 ft. long were then knocked down the sides of the pipe to prevent spring back. Before the work commenced it was thought that these stakes might also be used to detect any leakage at the points after backfilling was completed by using a sounding device on the tops of the stakes which would only be a few inches below ground level. A sound amplifier as used by the Water Companies on their mains was tried out but was found to be quite unsuitable.

Backfilling of Trench

When enough trench was ready to comprise a full day's work the labourers backfilled the trench in three stages. Bottom, middle and top layers consolidated each time by the feet of the workmen. The man filling the top layer also relaid the turf sod. Depending upon conditions, a day's backfilling for the gang of five men comprised anything from 800 yds. to 1,200 yds. of trench.

Crossing Roads and Obstacles on Routes

Several times along the route it was an advantage to cross the road to find a good grass verge for laying the pipe. The crossings were made nearly at right angles, all road excavation being left by the trench contractor to be done by the Board's own personnel just prior to pipe laying.

The road trench was excavated up to road centre and after plating of that half the remaining half was cut through. In the meantime a length of pipe had been prefabricated on the road side to span the full road width and bent round to fit the socket and spigot ends of the line on opposite sides of the road. On completion of the road excavation the plates were lifted and the prefabricated pipe dropped in the trench and the spigots knocked home in each side pocket. Fig. 3 shows how by tilting the pipe, one side joint could be welded while traffic passed unhindered over half the road width. The plates were then shifted over, the pipe tilted the opposite way and the second joint welded as before.

Although the greater part of the trench was excavated in road verges, it was found necessary at each end of the route to leave the road side and cut through fields in order to find easier conditions. At the Alnwick end a two-mile cross-country diversion not only shortened the route but prevented the work encroaching on any built up areas and the inevitable excavation in pavements, etc. At Rothbury the final mile of the main road made a large loop round a high wooded ridge of ground comprising part of a private estate. As this part of the main road contained no suitable verges and hard digging in road metal would again have been necessary, it was decided to take the pipeline over the ridge and drop down through several fields directly into the gasworks.

There were ten road crossings and five bridge crossings on the route, four of the latter were in the road metal, excavated to 1 ft. 9 in. depth, the pipe bedded in concrete similar to a road crossing. The remaining bridge was a shallow steel estate bridge where the pipe was taken through each acutment and hung exposed on the steel side member. Apart from this hard digging, many entrances to fields from the main road, especially in the neighbourhood of Alnwick, had to be crossed and access had to be maintained. In one section where 16 entrances occurred in 1,400 yds., progress was considerably held up due to the extra amount of hard digging required and the lack of sufficient steel plates for keeping the roadways open.

One railway was crossed and, although this was a disused line, British Railways stipulated that the main be isolated with a valve each side of their land and 3 ft. cover be maintained under the permanent way. The wayleave for this crossing was obtained from the British Transport Commission on an annual charge basis. Further wayleaves amounting to a total yardage of 4,442 were obtained from various other authorities and private individuals.

Cathodic Protection

About one month after the main was completed a survey of the route was carried out to determine whether it would be an economic proposition to apply cathodic protection against corrosion of the main. The survey showed that the greater part of the route lies through soil which, at the worst, could only be termed moderately aggressive and, at best, virtually non-aggressive throughout the greater part of the year. With the exception of one isolated section the minimum resistivity recorded with the meter was 3,000 ohms cms.

The exception was a portion of moorland road about 1 mile long where backfill had been imported from an adjacent old drift mine and contained a large proportion of blue clay. Here the resistivity dropped to 1,500 ohms cms., and was of course due to the contamination of the extraneous matter. Thus on the greater part of the route the relatively non-aggressive nature of the sub-soil did not justify the cost of cathodic protection. It is considered advisable, however, to protect the remaining 1 mile section and we propose to space six anodes, at 300 yards intervals, each provided with a test point box for the purpose of taking future test readings. The results obtained from the above tests will enable us to decide whether any further protection to the rest of the main will be advisable.

SUPPLIERS AND CONTRACTORS

Steel tubes for main	Stewart and Lloyds Ltd.
Rothbury H.P. gasholder	Oxley Engineering Co. Ltd.
Alnwick compressors	Geo. Waller and Son Ltd.
Rothbury governors	Jeavons Engineering Co.
Alnwick benzole plant	Sutcliffe-Speakman and Co. Ltd. (re-erected Carter-Horseley)
Recording instruments	Sigma Instrument Co. Ltd.
Hydraulic pipe bender	Chamberlain Industries Ltd.
Tubular truck	H. C. Slingsby Ltd.
Air compressor	Curtiss
Main cocks	Newman Hender and Co. Ltd.
Welding machines	Murex Welding Processes Ltd.
Welding rods	Murex Welding Processes Ltd.
Trench excavation contractor	Owen McGonagle Esq., Gretna, Carlisle.
Rothbury governor house building ..	Wm. Brown and Son, Thropton.
Alnwick compressor house building ..	J. Campbell Smith Ltd., Amble.

15

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† FREIBURG	2	2.8
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* LONDON (KENSAL GREEN)	1	2.5
* MILAN	1	3.5
* MILAN	1	1.4
* NAPLES	2	4.2
* ROME	4	8.5
† ROME	1	2.5
* LA SPEZIA	1	1.4
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21st AUTUMN RESEARCH MEETING

46th Report of the Joint Refractories Committee: 1953-54

THE Report was presented in the first place by Prof. A. L. Roberts and then, in detail, by Dr. Rigby of the British Ceramic Research Association. The following is an abstract of Prof. **Roberts'** remarks in introducing the Report (*Comm. G.C. 27*):

This year four main topics have been singled out for description in detail. First comes the promised analysis of the results of temperature surveys on continuous vertical retorts; secondly, we have Part II of the laboratory investigations on the effect of iron-spots on the durability of silica bricks in service. The latter work had gone as far as it can in the laboratory and leads to a satisfying conclusion; but we feel strongly that practical proof of the laboratory conclusions is needed before they can be generally accepted. The third section introduces us to a neat and non-destructive method of measuring what happens to the mechanical properties of silica and siliceous bricks, in this particular case, on heating. The data show that these materials are wayward and rather complicated in their behaviour; silica starts off by, in effect, dropping in strength, but changes its mind at higher temperatures and becomes very much stronger than it was originally. This fact is interesting to the academician and very important to him, but it is also of practical significance. The fourth section deals with an intensive examination of the refractoriness-under-load test, and is, in fact, an interim report of a special sub-committee engaged on co-operative work to try to pinpoint the difficulties that surround this particular method of testing.

Clay-quartz System

Among the progress reports of other investigations is a summary of the year's work on the clay-quartz system with which I am more directly concerned. Last year we reported fully on the rate at which quartz itself disappears on prolonged heating at high temperatures. This year we have been looking at the other side of the picture—what are the products of this reaction and what are the causes of the well-known variability of these products? These are deep waters into which many have dived in past years; the pattern on the sea bed is by no means clear, but the new approaches indicated in the report do seem to show that a pattern is, in fact, there.

Dr. Rigby said:—You have already heard from Professor Roberts that the report this year describes four major research items. The first section has an eminently practical flavour, for it describes temperature data recorded during the first six month's working periods of retorts at two different gasworks. The retorts at each works were of different construction; those at the first works were approximately rectangular in plan and employed lambent heating. At the second works the retorts were elliptical in plan and were heated by means of ten horizontal flues. The latter were built mainly of siliceous materials, whereas the retorts at the first works were in silica. At each works, temperatures were recorded at three levels in the two selected retorts, thermocouples being located approximately $\frac{1}{2}$ in. back from the carbonizing face, and $\frac{3}{8}$ in. inside the retort wall from the flue face. Since these temperatures were automatically recorded at 16 positions, the investigators at the end of the survey were faced with some six miles of recorder trace on which to base their general conclusions. The magnitude of this task was only overcome by designing and then building a special integrating machine to average the temperature records made during each day. These daily averages enabled the average temperature at both the flue face and the carbonizing face to be obtained by extrapolation. The data gave evidence of the large daily fluctuations in temperature that occurred at the carbonizing face and appeared to be caused by the erratic descent of the charge. When the temperatures were being recorded at Works 1, it was suggested that the North Thames Gas Board should endeavour to measure the temperature at the centre of the charge. This was determined and was found to be only between 100 and 200°C., although the carbonizing face temperatures 5 or 6 in. away were about 950°C. In other words, whereas the temperature gradient through the retort wall is 45° per inch, that through the charge is 160° per inch. The limiting factor in rate of carbonization would appear, therefore, to be the conductivity of the charge itself rather than the conductivity of the refractory material forming the retort wall. The gas industry has held this view for a long time, but I think this is the first occasion that measurements have been obtained to confirm what was a strong suspicion.

It is only with great hesitation that we have attempted to draw conclusions from these data relating to the working of the retort. We are acutely aware that we are not practical gas engineers, and we would much prefer the gas engineers themselves to derive their own conclusions from these data, since they know the idiosyncrasies of retorts much better than we can ever hope to know them. Mr. Laming would be only too pleased to try and incorporate the impressions of the gas engineers in another paper on this aspect of our work.

The second section of the Report is a continuation of the work reported last year on the durability of iron-spotted silica bricks. We have carried out many laboratory tests and from all these we can only derive one conclusion—that the coloured area surrounding an iron-spot cavity is quite as resistant as the remainder of the brick to all forms of chemical attack present in the gas retort. In theory perhaps one might object to silica bricks that have a cavity on the working face approximately $\frac{1}{16}$ to $\frac{1}{8}$ of an inch in diameter and rarely extending further than a quarter of an inch into the brick, but we must remember that the numerous joints in a gas retort are comparable in width to the diameter of the iron-spot cavities, but unlike these extend throughout the entire thickness of the retort. We consider we have now taken this problem as far as we can from the laboratory angle; we are equally certain that this project will not be satisfactorily concluded until one or more gas retorts are built, as far as possible, with iron-spotted material.

Properties of Refractory Materials

The last two major sections of the Report relate to more fundamental work on the properties of refractory materials. The third investigation is concerned with changes in the mechanical properties of silica bricks, both with rising temperature and after subjecting them to a number of heating and cooling cycles. It is comparatively easy to measure properties of refractory materials before they are built into a furnace structure, but it is often extremely difficult to forecast how these properties will be modified after the material has been in service for a few weeks. The investigation described in Section III aims to determine what modifications in properties can be expected from refractory materials after subjecting them to conditions not unlike those they will have to withstand in service.

Section IV is concerned with methods of testing. Many years ago the gas industry considered the possibility of including a refractoriness-under-load test in any specifications they might make with regard to their refractory materials, but rejected this test after results on certain fireclay specimens, obtained at a number of different laboratories, were found to be inconsistent. It was necessary to find the origin of these inconsistencies and a special Committee under the chairmanship of Dr. A. H. B. Cross, of the Firth Brown Research Laboratories, has been working now for three years with this object in view. The first Report of this Committee is given as Section IV of the

46th Report and it relates to the observations made on silica specimens which admittedly are likely to give more consistent results than fireclay specimens. Nevertheless, weaknesses in the test have been exposed, particularly relating to the methods of measuring temperature and to the uniformity of heating.

The Report concludes with a very brief summary of the work carried out during the year on other research projects of the Joint Committee. Perhaps I might draw your attention to one of these relating to the microscopic examination of scurf. Our early laboratory experiments relating to flaking led us to believe that the scurf layer was keyed into the retort brickwork, probably by way of the pores of the brick, and that differential expansion between scurf and brick resulted in the flaking away of the brick surface. Nothing we have carried out since suggests that this is a basically wrong assumption, but certain inferences drawn in all good faith have been found to be misleading. Scurf in bulk has an average coefficient of expansion about 6 to 7 $\times$ 10^{-6} and the logical deduction was made that if gas retorts were built with a refractory material possessing a thermal expansion similar to scurf, flaking should be reduced. This inference, however, did not take into account the peculiarities of scurf. A comparatively new microscope technique involving the preparation of polished sections has now revealed that scurf is not as amorphous as the X-ray would have us believe; its structure is more closely allied to the flake-line nature of graphite. Graphite has practically no thermal expansion in the plane of the crystal flakes, whereas at right angles to these flakes the thermal expansion coefficient is very high, of the order of 30 by 10^{-6}—approximately six times as high as a firebrick or sillimanite brick. The microscope has also suggested that both within the pores and at the surface of the refractory material the scurf is deposited with the flakes parallel to the surface and perpendicular to the diameter of the pores; that means to say that from the viewpoint of differential expansion coefficients, the average coefficient of expansion of scurf may not be as important as the expansion of thin layers of orientated flakes in a specific direction. Temperature variations may, therefore, set up large stresses within the pores of refractory materials even though they have an expansion coefficient comparable with the average expansion of scurf.

The best method of inaugurating further work on the problem of flaking is now concerning several of us at the Research Association. We have no laboratory method at the moment by which we can simulate flaking and thereby arrange a number of refractory materials in an order of merit with regard to flaking resistance. In such a problem as this, the quickest results can often be obtained by a combined laboratory and field investigation in which we determine in the laboratory all those properties of a number of refractory materials which we think are closely or remotely related to flaking tendency. Such refractory materials are then placed in the flaking zone of a number of retorts and examined at intervals. By such service tests we may then find that material A is more resistant than material B, and by knowing the properties of both A and B as determined in the laboratory it is often possible to elucidate those properties that affect flaking. There is then a possibility of developing refractory materials that have increased resistance to flaking under service conditions. We urge that the gas industry should favourably consider such a series of carefully planned investigations with the assurance that in other industries this combined method of approach has often given the answer more quickly than either field tests or laboratory experiments carried out without liaison between the two.

My colleagues and I are of the firm opinion that the preliminary trials which have been reported to the gas industry, and which were made with silica bricks derived from different quartzites, have produced most helpful pointers with regard to this problem of flaking, although these trials were on a small scale. We think there is every prospect that an extended programme on these lines would produce results of great value and would produce them within a reasonable length of time.

DISCUSSION

Mr. R. J. H. Banks (North Thames Gas Board), opening the discussion and speaking as the Station Chemist at Works 2, said that those who had seen Mr. Laming at work and the interminable unwinding of his 16-point recorder chart had a very high opinion of the great industry and ingenuity displayed in averaging the records and reducing them to manageable form. Mr. Banks discussed in detail the differences between the necessarily hot-spot readings of the optical pyrometer and Mr. Laming's thermocouple readings. The differences varied widely, and he would like to know particularly if Mr. Laming had any comment to make on the marked rise in flue wall temperature noted in chamber 7 for period 6 which appeared to have been unattended by any significant parallel increase in optical reading.

Mr. H. H. Carey (Woodall-Duckham Construction Co.) called attention to a small point which the author might have overlooked. At the level of the lowest thermocouple the retort end is not backed by solid brickwork; the thermocouple passes through a division wall in a vertical flue containing secondary air. The outward flow of heat at this level may have been due to the air in this flue being cooler than the coke in the retort. Mr. Carey, examining the figures in detail, questioned whether the thermal conductivity of the charge at 15 ft. depth was anything but a little less than that of the retort silica wall, and whether the readings set out in Figs. 2 and 4 (Works 1) were typical of the bench as a whole.

Mr. S. J. F. Beale (Derbyshire Silica Firebrick Co.) welcomed the promise of a further report on temperature conditions during scurfing retorts, and hoped that thermocouples could be placed at the interface of scurf and retort brick so that rise of temperature due to combustion at the point could be measured. He also welcomed the decision so far with regard to iron-spots and the proposal of a practical trial. In the meantime it was desirable to consider whether there might be, now, some amelioration of the standards applied for rejection of goods on this ground.

Properties of Scurf

But he was most intrigued by the investigations into the properties of scurf. 'If the greatest expansion of the graphitic layers forming the scurf is likely to take place within the pores of the retort material it would seem that low permeability will be of vital importance whatever refractory is used. This fact will have to be borne in mind when considering the latest evidence of permanent increase in permeability of some silica bricks which occurs on reheating to temperatures above 400°C. This evidence, together with the indications of other effects of reheating, poses the question whether the unused retort material should be tested as received, since permeability and Young's Modulus in this state have little relation to these properties of the material when heated to operating temperatures.'

Mr. J. Sharp Smith said it would seem that when they had Mr. Laming's next paper, dealing with the scurfing period, they would have a complete picture of the temperatures to which refractories in continuous verticals might be subjected. It would be interesting to have similar information for intermittent verticals, in view of the difference in the degree of flaking in the two systems. Mr. Sharp Smith thought that some, if only tentative, limit should be set to the size of the iron spot which should be tolerated, before a works trial is made of iron spotted material. Dr. Rigby had suggested that such spots $\frac{1}{8}$ in. in diameter by $\frac{1}{4}$ in. deep were inocuous; would he say that this should be the limit?

Mr. L. R. Barrett (Imperial College) referred to the type of thermocouple alloy used in the observations reported. He thought that the alloy used at the Building Research Station, 5% rhodium in the one arc and 20% rhodium-platinum alloy in the other, would be superior. It had a shown 'a tremendous stability,' and he thought it might be just what was required for the refractoriness-under-load test.

Refractoriness-under-load Test

Dr. A. T. Green wound up the discussion in a characteristic speech. He repeated his insistence on the importance of work in the field. 'This temperature survey was conceived . . . not with a desire to prove anything very deliberate and very deep but to get some idea of what was happening inside the retort.' On the refractoriness-under-load test he said that 'the economics of running a test have to be weighed carefully in the balance.' It was a question 'of trying to get a control of variables but allowing those variables which are not very important to the eventual result not to be so fully controlled in order to obtain something which is serviceable and economical.'

Explosion Reliefs for Ovens

A summary of the paper to the AUTUMN RESEARCH MEETING of the INSTITUTION OF GAS ENGINEERS by Mr. P. A. Cubbage and Dr. W. A. Simmonds, Midland Research Station, The Gas Council, and a report of the discussion.

DR. W. A. SIMMONDS, in presenting the paper (*Comm. G.C. No. 23*), said that since town gas and air in certain proportions formed an explosive mixture, there was obviously a possibility of dangerous conditions occurring in gas-operated appliances. Explosions did occasionally occur and it was clearly in the interests of the gas industry to reduce the number of such events and to ensure that they had no serious consequences. Many incidents of this nature were due to foolishness or carelessness on the part of the operator, and often the only way of preventing such occurrences was by propaganda, emphasizing the need for care in the prevention of accidents and the necessity of following the correct operational procedure. However, if a coherent group of incidents with a single underlying cause could be found, there was then scope for preventing either the explosions or the damage caused by them.

From the industrial accident statistics collected by the Ministry of Labour, the Factory Department had drawn the authors' attention to one such group which consisted of explosions taking place in drying ovens. Most of these explosions could have been prevented by fitting flame failure controls, and this policy had been recommended by the Industrial Gas Development Committee. However, the possibility of faulty installation of flame failure controls or failure to maintain them adequately meant that it was not certain that all explosions would be prevented by fitting these controls. Additionally, since in the majority of cases the vapour evaporated in the drying process was inflammable, there was a risk of explosions of vapour-air mixtures. The damage caused by these and the few gas explosions which might occur even when flame failure controls were fitted could be prevented by the use of explosion reliefs. Until now, there had been almost no information available on which the design of explosion reliefs for drying ovens may have been based. The authors' object, therefore, had been to obtain and formulate data enabling such reliefs to be safely designed.

Box Ovens

Dissection of the statistics already mentioned showed that explosions were a more serious problem in box ovens, *i.e.*, the batch type of oven, than in conveyor ovens which were continuously operated. Since explosion reliefs were most conveniently and commonly inserted in oven tops, the design of these has been considered first.

As a result of the experiments carried out, the authors were now in a position to define how a relief should be designed for insertion in the top of a box oven. The steps in this process could be summarized as follows. In the first place, a method of constructing a relief in such a way that it was harmless in operation had been developed and proved. Dr. Simmonds pointed out that many reliefs at present being installed were in themselves lethal weapons when blown off an oven by an explosion. Secondly, the necessary area of the vent was found from the strength of the oven, which was best assessed as the maximum pressure allowable in the oven. Thirdly, the maximum weight of the relief was then determined. Finally, the necessary clearance around an oven to enable the relief to function satisfactorily and to ensure that personnel were not burned by flames vented from the oven was found. The area, weight and clearance might readily be determined from data given in the paper. Usually the maximum permissible pressure that could be allowed in an oven was not known, and a design pressure to form a working basis in these circumstances was suggested in the paper.

All of this applied in particular to ovens that were approximately cubical in shape and had no solid shelves, nor shelves that were virtually solid because of heavy loading with stock. If such shelves were used then, of course, a relief in the top of the oven was of no great use for an explosion ignited below the shelf, and it was necessary to have a relief in the side or back of the oven. Experiments were now in progress to determine design data for these. The venting area would be the same for both positions, and the necessary clearance for safe operation and the avoidance of burns would also be similar in the two cases, although probably more difficult to arrange in practice for side vents. Thus the main difference between reliefs in the top and sides of ovens was that in the top position both the weight and the inertia of the relief influenced the speed with which it was flung from an oven, while in the side position only the inertia was important. Therefore, for a particular oven, the maximum permissible weight of a relief to prevent the pressure inside the oven rising above a certain predetermined value would be greater for a relief in the side of an oven than for one in the top. However, since it was necessary to make the reliefs very light in order that they should be harmless in operation, this difference was not important. It might therefore be stated quite definitely that the data already obtained might be applied quite safely to the design of vents in the side or back of ovens. The experimental investigation of side reliefs now in progress could only lead to a slight relaxation of the design requirements deduced from the present data such that slightly heavier reliefs could be used, but even this was subject to the provision that they did not prove to be dangerous in operation.

Other Work

Other work now in hand involved the influence of the shape of the oven and of the vent on the design of reliefs, the influence of the temperature of the vapour on the pressures developed during vapour explosions, and the venting necessary for the heating channels of treble-cased ovens. It was eventually intended to consider the design of reliefs for conveyor ovens.

The authors fully realized that they were only half way to the solution of the problem of preventing damage due to explosions in drying ovens when they had obtained the design specification for suitable reliefs. The second part of the job was to get these reliefs actually installed into ovens. They were now concentrating on this aspect in close co-operation with the headquarters staff of the Factory Department, and it was very pleasing that the discussion on this paper was to commence with a statement of their views on the subject.

The response from certain manufacturers in the short time that the results had been available had been most gratifying, and Dr. Simmonds said he understood that, in the case of at least one manufacturing concern, such reliefs would be installed as a standard feature in all new ovens in the very near future. He hoped that more should be heard of this development in the discussion that was to follow.

DISCUSSION

Mr. J. H. F. Smith (H.M. Chemical Inspector of Factories) said that although the paper was primarily concerned with explosion reliefs for box ovens heated by gas, it would be of great importance in connection with all sorts of explosions of solvent vapours in plants heated by fuels other than gas—oil mist explosions in oil-fired plant, explosions of various gases and vapours in a variety of chemical plants, and in connection with dust explosions. When he had first seen the paper he had made the remark that it might prove as great a step forward in safety as the Davy miner's safety lamp had been in its time. One of his colleagues had agreed, and had summed up the whole paper by pointing out that there was the big difference that Davy used a fine wire mesh gauze to keep his flames in.

whereas the present authors used a 3-in. mesh to let their flames out.

Mr. R. F. Hayman (Industrial Gas Officer, The Gas Council) said that the Factory Inspectorate, who had been closely associated with this work, had come to the conclusion that the time had come for explosion reliefs to be fitted in all box ovens, and that vapour hazards in electrically-heated ovens were just as real as in gas-heated ovens for similar duty. He expressed his opinion that this valuable investigation must continue, so that the problems relating to the effect of heavy loading, solid shelves, and forced convection could be solved. If it became possible, as it should, to apply as rapidly the results of other fundamental investigations in industry, a new era in industrial appliance design could be expected.

Mr. R. J. Broomer (E. J. Ballard & Co., Ltd.) said that in the double-case box oven there was little difficulty in incorporating the type of relief discussed. The treble-case oven offered some problems, but with a little ingenuity they could be overcome. He had been permitted to bring a model showing the top of a typical treble-case oven with this type of relief incorporated. The relief panel from the inner case of the model was twice the area required by the authors' formula, but in view of the fact that in most cases the strength of the oven was unknown this doubling of the recommended area would give a reasonable safety factor. It had been the practice in the past to fit explosion reliefs to box ovens only when the purchaser had agreed to it as an extra or, being safety-conscious, had asked for it. As manufacturers of ovens his company felt that the explosion panel formed an essential part of the oven, and on all future production models explosion reliefs would be fitted as standard equipment. He added that the new type of relief, coupled with modern production methods, should not add to the overall cost of production.

Dr. F. E. T. Kingman (Fire Research Organization) spoke of Fig. 4, which showed the variation of the pressure with composition of the gas/air mixture. That curve was a little steep, he thought, and he wondered whether it had been correlated with the flame speed of mixtures of those compositions in the same way as in Fig. 22, relating the first peak pressures with the combustion velocities of a number of combustible materials. He said that in the construction of the relief, in which the authors spoke of tucking down the aluminium metal at the side, it was important to reinforce the warning given there that no attempt should be made to constrain the relief. He was not certain what would happen to the pressure at which the relief would blow if the edges were constrained. The authors called attention to this, and he thought that it was an important point.

Mr. Shave (Barlow Whitney, Ltd.) felt that some protection around the explosion relief might possibly be necessary to ensure that the blast effect be minimized as much as possible The extent of the blast effect might be minimized by shields of suitable texture both at the top and also applied to covers with back and side reliefs. He asked the authors whether some work could be done in their programme on this aspect of the matter.

Mr. A. Higgs (Assistant Industrial Gas Officer, West Midlands Gas Board) said that the authors had rightly emphasized the need for adequate clearance between the explosion relief and the roof or ceiling and had also given valuable guidance on actual flame spread in the vertical and horizontal planes. This information was presumably intended to assist in defining a region beyond which operatives would not receive severe injury, but the effects of blast on personnel and the building must not be overlooked. A simple calculation based on Fig. 13 showed that the combustion products were being discharged at a speed somewhere in the region of 500 m.p.h. and hot gases at such velocities could, of course, cause injury and damage well beyond the area of flame spread. Where back vents were employed this high issuing velocity and/or blast effect required careful consideration, as obviously operatives were much more prone to injury from this source than with top vents.

Mr. J. H. Harris (Chief Oven Engineer, Metal Box Co., Ltd.) said that his company's method of dealing with the hazards involved in the use of box ovens was simple and foolproof; they were never used.

Oil and Gas Firing

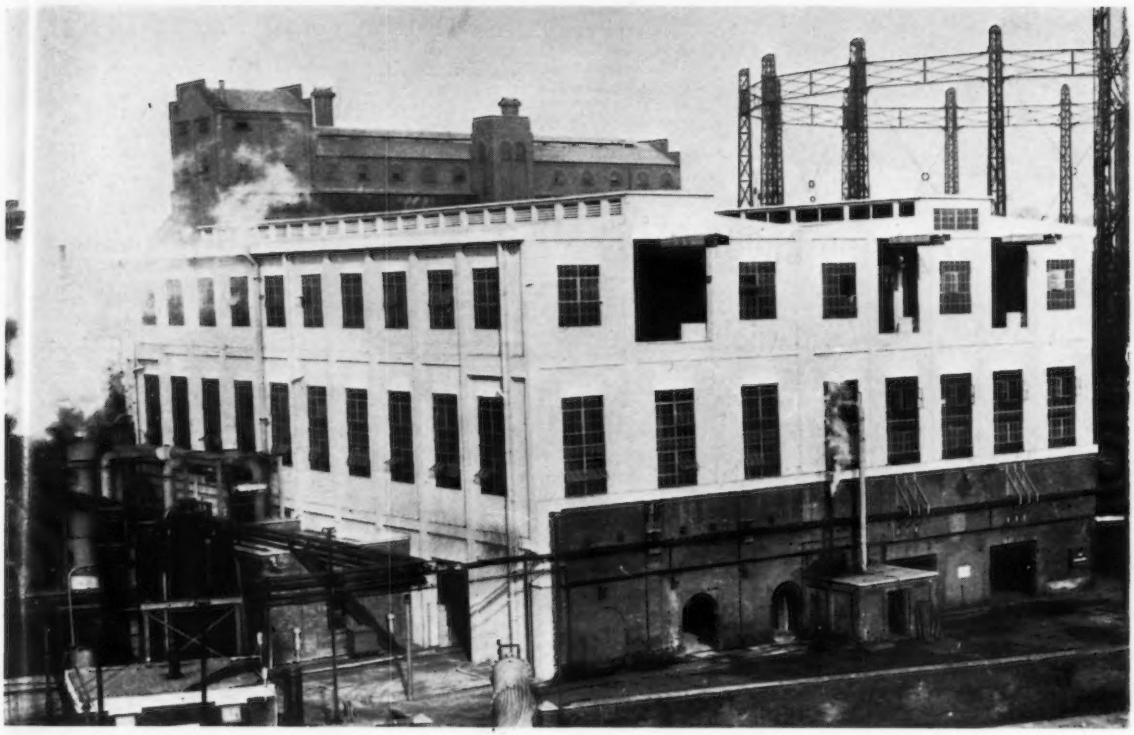
DR. D. T. A. Townend presented to the International Flame Research Committee recently an address entitled: 'The Combustion of Solid Fuels and the Aims of Flame Radiation Research in Relation to the Burning of Pulverized Coal.' The following is an abstract of that part of his address dealing with oil and gas firing:

The tests using oil and gas flames undertaken over the last six years have provided a wealth of experimental data. Indeed, one of the principal difficulties experienced has been to present the results in a form assimilable by the designers and users of combustion appliances. A main outcome of the work would seem to be evidence for the prediction that the rate of mixing of the gaseous or liquid fuel with the combustion air is the predominant factor controlling the rate of combustion and subsequent heat release. The rate of mixing is controlled by the momentum imparted at the burner; increased momentum gives rise to a shorter, hotter flame.

As is well known, the radiation from a flame is a function both of temperature and of the emissivity of the gases and solid particles, and thus radiate nearly four times as much heat as, pitch creosote are employed as combustibles, the flames give emissivities approaching unity due to the presence of solid particles and thus radiate nearly four times as much heat as, say flames using coke oven gas at the same attained temperature. Methods of increasing the emissivity of flames were, therefore, pursued and, while it was found, on the one hand, that the radiation from a coke oven gas flame enriched by up to 15% of fuel oil, increased proportionally with the amount of oil added, it was shown on the other hand that, with heavy fuel oil and pitch creosote flames, about 20% and 30% of these fuels, respectively, could be replaced in flames of the same size as those in the Ijmuiden furnace by coke oven gas without any loss in emissivity of the resultant flames.

These and other results suggest that, first, a significant increase in the emissivity of flames of low luminosity is more difficult to obtain than the necessary temperature rise to give the same additional heat flow; and second, with highly luminous flames of industrial dimensions, it is equally difficult to cause an appreciable drop in the overall emissivity. Hence, for example, it is often possible by, say, increasing the burner momentum, to get a hotter luminous flame without impairing its emissivity characteristics.

Knowledge of the combustion mechanism of the residual coke in pulverized fuel flames is mainly a matter of extrapolation from the behaviour of macroscopic particles to which some reference has already been made, but it seems fairly definite that once ignition is established, most of the burning time is spent in consuming the residual carbon. Attempts to calculate these burning times are based on the mass transfer approach already referred to, diffusion being the controlling factor. Fair agreement has been obtained between calculated and measured values, but this does not necessarily justify all the assumptions made. Only a limited amount of work has been reported upon semi-scale work relative to pulverized coal combustion. Prominent among the earlier workers were Audibert, and Sherman whose furnaces dealt with about 100 and 200 lb. coal per hour, respectively. At the time of this work, pulverized fuel firing under boilers was only just being established and the intention of the experiments was to provide data immediately applicable ot large-scale practice. Sherman's data, in particular, seemed to be consistent with what information on large-scale practice was then available. His main findings were that (a) the amount of unburned carbon at first fell sharply with residence time and then more slowly, and (b) the rate of burning increased with the volatile matter content of the fuel, and (c) the degree of combustion increased with furnace temperature. With a view to anticipating the behaviour of various coals in dry bottom pulverized fuel furnaces, work is proceeding at the B.C.U.R.A. with two small scale pulverized coal furnaces (5 lb. per hour and 50 lb. per hour). It is hoped with these furnaces to provide data indicating the likely behaviour in service of coals having varying sulphur and chlorine contents.



Operation and Control of Deep Purifiers at Ipswich*

By W. Hayston, Assoc.M.Inst.Gas E., A.M.Inst.F.‡ and D. G. Wright, A.R.I.C.¶

THIS paper deals with the operation and control of a set of five housed purifiers each 40 ft. by 24 ft. by 13 ft. 6 in. deep purifying gas with a hydrogen sulphide content of up to 1,000 grns. per 100 cu.ft. The effects of the high H_2S content of the inlet gas, slow dissipation of heat generated and atmospheric temperature on the working temperatures and oxide condition are shown. Maldistribution, caused by the various bulk densities of the four layers of oxide, due to the various heights of drop when filling, is discussed, together with the difference of outlet temperatures and H_2S extractions of the two halves of a box when working with split flow.

The five boxes were installed in 1946 by C. & W. Walker, Ltd., and designed to handle 6 mill. cu.ft. of gas per day. There are no catch boxes. The boxes are of cast iron construction and are supported 18 ft. above ground level with a 'revivifying floor' some 11 ft. above the lid level. A concrete building (above) completely houses the boxes. Milbourne Patent double faced valves are used for rotating the working sequence and are operated from the purifier floor level. Each purifier is fitted with inlet and outlet manifolds placed diagonally opposite. Each contains three single faced valves for controlling the direction of gas flow through the box. These valves are connected to the top, middle, and bottom of the box respectively. By means of these 'distribution' valves it is possible to pass the gas through the oxide in eight different ways as well as providing a means of completely by-passing the oxide. (Fig. 1 and 2.)

Water sealing U-pipes are incorporated in the connections to the inlet and outlet of each box as well as midfeather chambers between the boxes. Each box holds approximately two hundred and five tons of oxide arranged in four layers two of 2 ft. 3 in. deep and two of 1 ft. 6 in. deep. There being a shallow and a thick layer in each half of the box.

Gas-making plant consists of Woodall-Duckham continuous vertical retorts fed with South and West Yorkshire coals. Adequate condensing plant is in use to reduce the gas temperature to 55° to 60°F. before the gas enters the exhausters. The final traces of tar are removed in a 6 mill. cu.ft. per day electro detarrer before the gas is scrubbed for ammonia in a 6 mill. cu.ft. per day eight bay static washer.

Oxide Mixtures, Preparation, and Handling

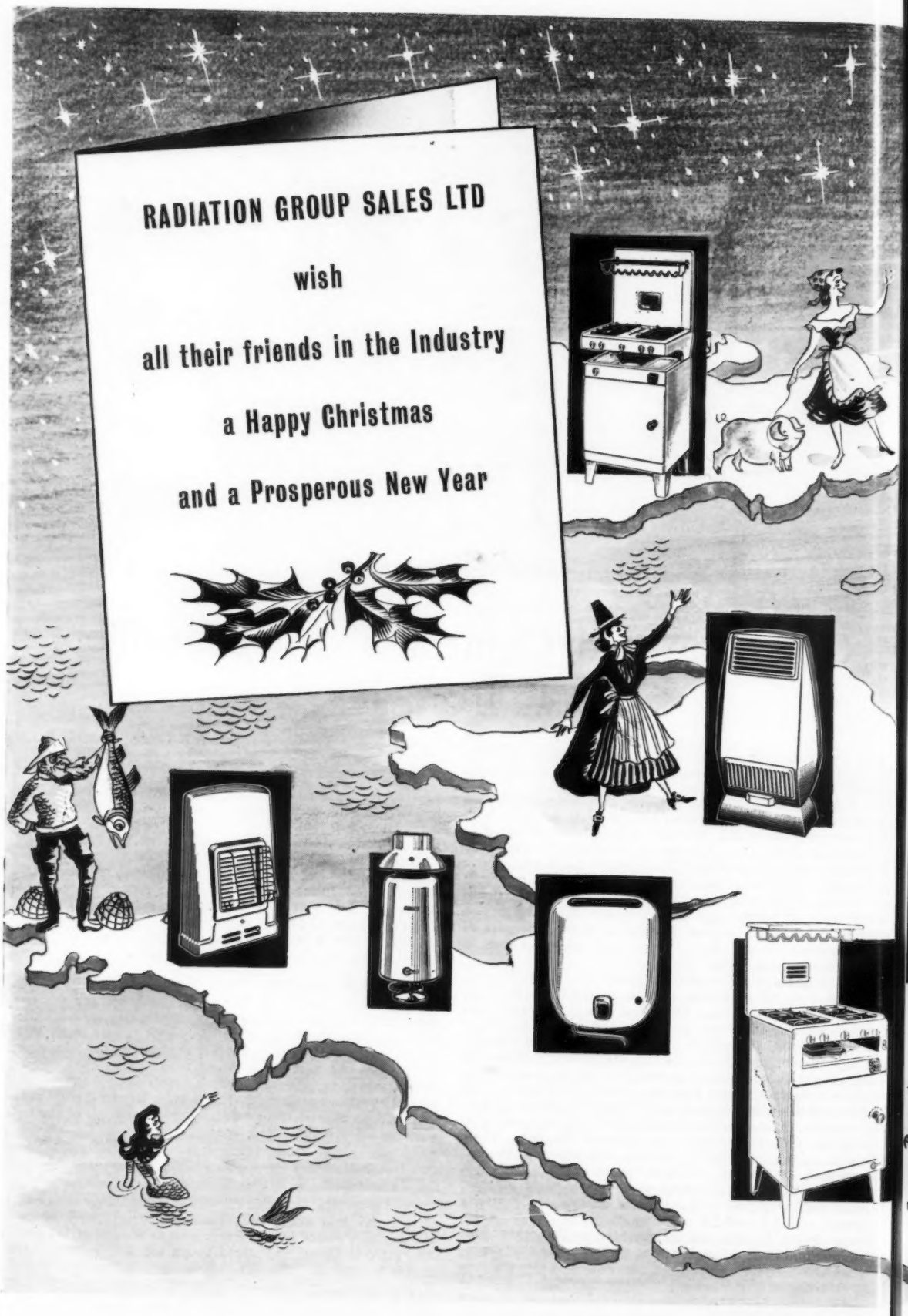
The various mixtures of Danish or Dutch bog ore and part spent oxide that are used depend upon the rate at which they will have to work during their life. This results in mixtures containing up to 75% of new oxide used during the winter and up to 75% of part spent oxide used during the summer. This seasonal variation in mixture assists in the temperature control as well as ensuring that there is no large and embarrassing build up of part spent oxide. Typical analysis of the two extremes of mixtures used, are:

	% H_2O	% S
75% part spent oxide: 25% bog ore ...	32.2	30.1
75% bog ore: 25% part spent oxide ...	35.3	13.5

After preparing the oxide mixture it is loaded by the Chaseside shovel into skips, each holding approximately 30 cwt. and raised by means of an electric hoist to the revivifying floor. The oxide is tipped and stored above the box to be charged until it is required. (Fig. 3.) The oxide is hoisted and placed in position at approximately 12 to 14 tons per hour by five men and the Chaseside driver who are paid at piecework rates.

* From a paper presented to the Eastern Junior Gas Association, December 13, 1955.

‡ Technical Assistant, Ipswich District, Eastern Gas Board.
¶ Chief Chemist, Ipswich District.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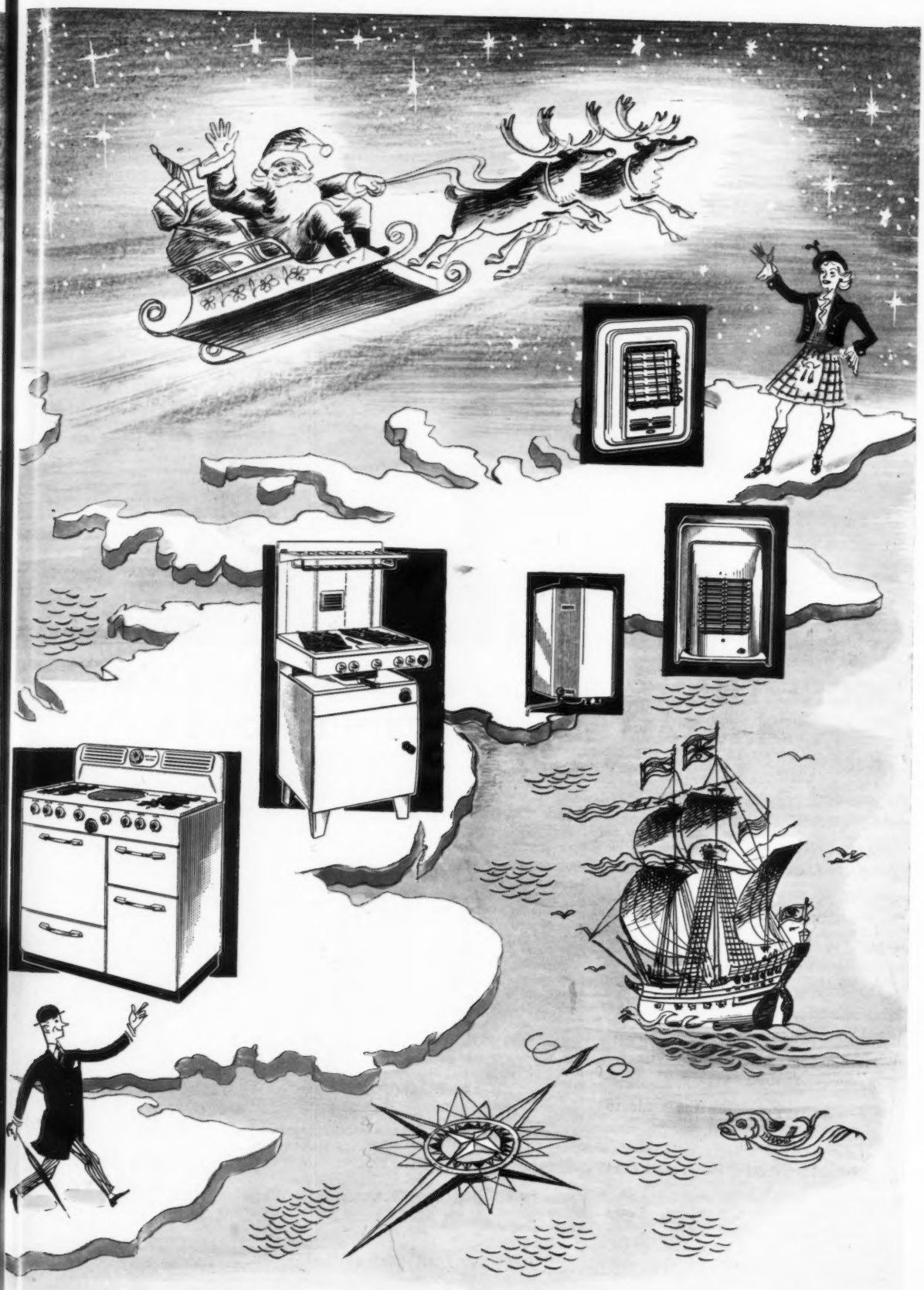

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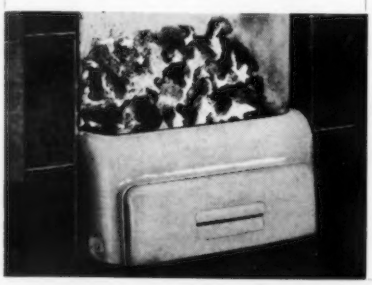

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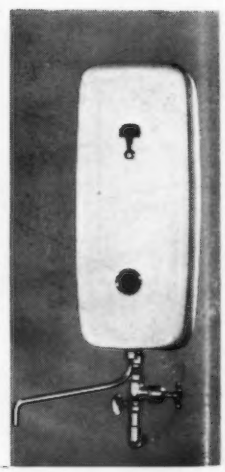

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If the oxide is heaped over the holes in the revivifying floor some difficulty is experienced in finding them and starting the oxide flow. To overcome this difficulty mild steel shute sections have been made to fit in the holes and the oxide is stacked around them. The discharged oxide is removed from under the purifiers by means of a specially adapted Chaseside shovel, and broken in a Crone and Taylor disintegrator.

The purifier to be discharged is placed in the last taker position on the Sunday morning before discharging. It is shut off on Monday morning and the appropriate water sealing U's and midfeather chambers are flooded. The CO_2 is fed from 28 lb. cylinders into a steam heated manifold which is designed to handle six cylinders simultaneously. (Fig. 4.) From the manifold the CO_2 flows through an 8 in. pipe with 6 in. connections to each box, and enters the box through a valve placed low on the side. It normally takes six hours to purge a box with sixty cylinders of CO_2, by which time there is 70% CO_2 at the cover level.

Discharging commences on Tuesday morning and is carried out by sixteen men, divided into four groups of four each working in separate corners. An attempt is made to arrange the men so that discharging is carried out uniformly throughout the depth of the box. At the end of each day's discharging any exposed grids are removed and the discharge doors are replaced. These measures are carried out in case the oxide ignites while still in the box. In the event of the shift foreman discovering overheating during the night he can immediately turn on six cylinders of CO_2 that have been fitted to the manifold in readiness or can call assistance and spray the oxide with two firehoses working at townwater pressure. Two sets of breathing apparatus are available near the entrance to the purifier house.

The exposed grids are removed in order that there is no difficulty in spraying any ignited oxide dust beneath the layer that is being discharged. A fire in No. 2A during 1952 started by the overheating of this dust. The CO_2 which was put into this box was the main factor in extinguishing it. The ease of using the CO_2 cylinders is one of the main reasons for using them rather than an inert gas machine.

During the charging operation, eight men are on the revivifying floor shovelling the oxide down the canvas shutes, four men are laying grids, two men are guiding the canvas shutes (two of the eight shutes being used at a time) and two men are raking the oxide into position. Before replacing the freshly charged box in the gas stream it is purged with coal gas, and the various water sealed valves are drained. Freshly charged boxes are normally returned to work on Thursday evening or Friday morning. It is therefore impossible to rotate the purifiers for four to five days during which time 20% of the purification capacity is out of action. If shallow elevated boxes of the equivalent capacity were used only 10% would be out of action for probably less time.

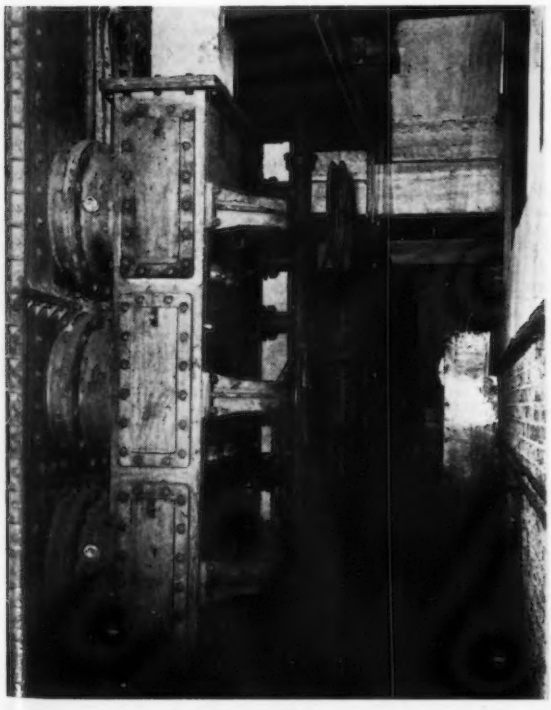

Fig. 1. The outlet distribution valves, showing position of valve thermometers.

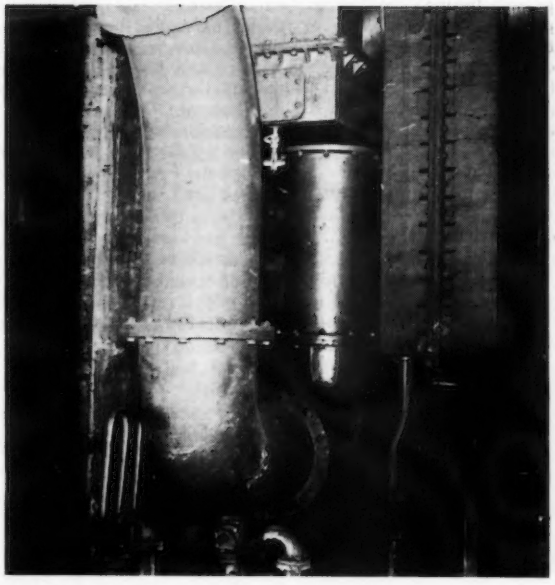

Fig. 2. The inlet 'U' of a box, and the midfeather chamber.

Revivification of Part Spent Oxide

The space for storing the part spent oxide near the purifier house is restricted (approximately 450 sq. yds.) so its revivification leaves something to be desired at times. This same space is used for the oxide mixing. Maximum revivification must therefore be carried out in the purifiers. The use of the top floor of the purifier house as a revivifying floor is prohibited by the high cost of hoisting, spreading and turning of the oxide by hand, as well as the cost of returning the oxide to the ground again for efficient mixing. The firing possibility of part spent oxide stocked in the purifier house must also be considered.

Prior to the installation of air blowers the air for revivification was drawn into the gas stream at the condenser outlet. This air was controlled to give 1.4 to 1.6% O_2 at the inlet of the first taker. Since the commencement of air blowing air to the equivalent of 1.2 to 1.4% O_2 has been blown into the gas stream. However, it has been necessary to reduce the air to give 1.0 to 1.2% O_2 during the warm summer months. Town gas contains between 0.4 and 0.6% O_2. The ammonia entering the purifiers is controlled to 15 to 20 grns per 100 cu.ft. which has been found to give reasonable *p*H values in the discharged oxide. A reduction in the ammonia slip was made during 1950 and 1951 though this was increased after a box overheated and had been ascribed to the reduction of ammonia slip.

Maldistribution of Gas with Split Flow

The back pressure thrown by the bottom two layers is greater than that of the top two layers, resulting in a preferential travel of gas through the top two layers. This difference of resistance to gas flow is caused by the higher bulk density of the bottom two layers.

It follows that there is more purifying material per cu.ft. in the bottom two layers, which have less gas to purify than the top two layers, with the consequence that the gas passing through the lower half is more efficiently purified. There is also a slower rate of gas travel through the bottom layers which should also help by giving the oxide more time to react with the gas. The accumulative effect of less gas

passing through the bottom two layers and their high activity per cu.ft. of oxide charged, together with less heat loss from the bottom of the box than from the covers, is probably the cause of the higher gas temperatures and lower H_2S concentrations observed at the bottom of the box when the gas flow is in middle and out top and bottom. Those reasons and the fact that the water drips off the oxide in the bottom layer instead of on to the oxide as in the top layer account for the dryness of the former and wetness of the latter. With maldistribution the R rate for the stream has little or no significance. There are various possible methods of overcoming this maldistribution:

(1) Equalizing bulk density of the layers
  (a) Reduction of bulk density of bottom layers.
  (b) Increase of bulk density of top layers.
  (c) Altering bulk density of all layers.
(2) Reduce thickness of oxide in bottom layers
(3) Increase thickness of oxide in top layers
(4) Partly close top valve.

1a. By this method there would be a reduction of the weight of oxide in the box which would necessitate a shorter life while the operating temperatures might be lower.

1b. The weight of oxide in the box would be greater than at present thus allowing a longer life but there would be more back pressure and probably higher working temperatures.

1c. This could be achieved by dropping all oxide on to a platform and then shovelling into position. However, the bulk density would be lower than any of the present layers, with

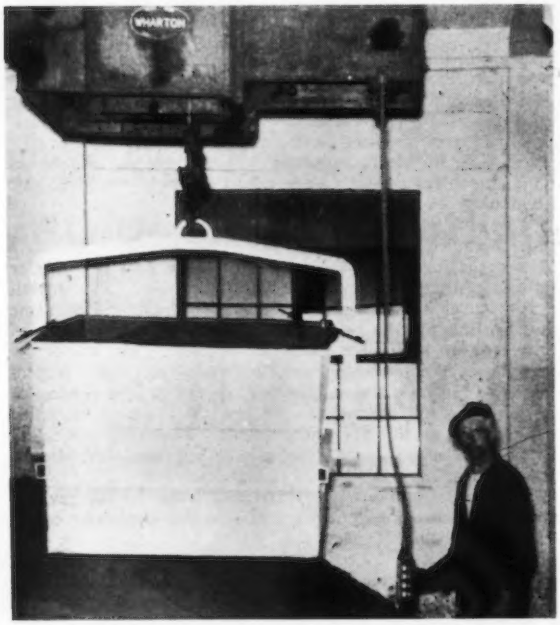

Fig. 3. Oxide skip in position for tipping.

the same disadvantages as 1a. as well as increasing the cost of charging and time taken.

2. The weight of oxide in the top and bottom sections could be equalized by reducing the thickness of the bottom layer to approximately 2 ft. with a reduction of the weight of oxide by approximately 4%. This has been tried but with little or no success.

3. Increasing the depth of the top layers is restricted by the position of the grid bearers, etc. However, an increased depth of the 2nd layer down is now being tried.

4. To even the back pressure thrown by the top and bottom sections of a box it is necessary to practically close the top valve. Some time and risk is involved with adopting this method as well as upsetting the work of the box.

Working Temperatures

Deep purifiers have less surface area per ton of oxide contained than have the ordinary shallow purifiers, and so they allow less dissipation of heat, which, depending upon the local conditions can be either an advantage or a disadvantage. At Ipswich we have found that the most efficient extraction of H_2S is achieved by working the first three takers with outlet gas temperatures of 90°F. to 95°F., and allowing the last two takers to cool. However, in summer these temperatures are frequently exceeded.

Although the concrete building helps with the maintenance of suitable working temperatures in winter and shields the purifiers from the direct heat of the sun in summer there is consequently very little air movement within the building. Partly to overcome this difficulty all the fixed windows up to the purifier cover level have been removed. It has been necessary at times to spray the covers with water but this merely reduces the gas temperature entering the following box and increases the difference between the outlet gas temperature indicated and the actual temperature of the oxide thus increasing the uncertainty as to the oxide condition. During the spring of 1955 approximately 5,500 tons of German coal were delivered to the Ipswich works. When carbonized this coal gave a gas with an H_2S concentration of 450 to 670 grns. per 100 cu.ft. and it was found that the temperatures of the first three boxes could be worked some 5 to 10°F. lower than normal.

Outlet H_2S Concentrations and Temperatures

Due to the maldistribution with split flow caused by the various bulk densities of individual oxide layers it has been found that the gas leaving the bottom of the box is warmer and contains less H_2S than that leaving the top of the box. Testing of the top and bottom outlet concentrations of H_2S have been carried out on the 1st taker for over two years. The results when summarized show:—

H_2S extracted by top two layers—416 grns. per 100 cu.ft.
H_2S extracted by bottom two layers—498 grns. per 100 cu.ft.

The thermometers that are placed in the top and bottom outlet pipes are read and recorded at least 24 hours after rotating. Differences of up to 33°F. have been noted between the two outlets while up to 18°F. has been noted between the bottom outlet and the mixed gas temperature. In all cases the bottom outlet temperature is higher than the top outlet. The difference is found to be greatest after the oxide has partly dried out and when a box is in the 2nd taker position.

Average of difference between the top and bottom outlets from April to October, 1955, with 1st and 2nd box air admission are:

1st Box Air Admission		
1st taker	..	11.3° F. difference
2nd ,,	..	13.4° F. ,,
3rd ,,	..	11.0° F. ,,
4th ,,	..	8.8° F. ,,
5th ,,	..	7.6° F. ,,

2nd Box Air Admission		
1st taker	..	11.0° F. difference
2nd ,,	..	14.9° F. ,,
3rd ,,	..	11.5° F. ,,
4th ,,	..	9.5° F. ,,
5th ,,	..	9.4° F. ,,

Part of these differences will of course be due to the extra cooling effect on the covers. It would in fact be interesting to see the effect of lagging the top and the bottom of a box. No satisfactory estimate of the actual quantitative distribution of the gas through the top and bottom sections can be made from these temperatures and H_2S results because of the inability to be certain of complete mixing before the combined outlet is measured. Maximum and minimum thermometers that were placed in a box indicated temperatures up to 142°F. had been experienced in the bottom layer near the outlet, and 117°F. in the top layer also near the outlet.

Life and Frequency of Rotating

The normal life aimed at is 700 mill. cu.ft., though when the boxes were first put to work lives of over 1,000 mill. cu.ft. were reached. Over the last three years the life has varied between 123 and 194 days.

The purifiers are discharged in the sequence 5, 4, 3, 2, 1 and there is no variation in life with the different mixtures used. The amount of sulphur absorbed during a box's life depends upon the work done by its charge in first taker position and upon the work done by the other boxes during its life. It will not necessarily absorb, say, one fifth of the sulphur entering the purifiers during its life, so no accurate estimate of possible sulphur loading by this method can be made if the boxes contain different oxide mixtures. However, this method

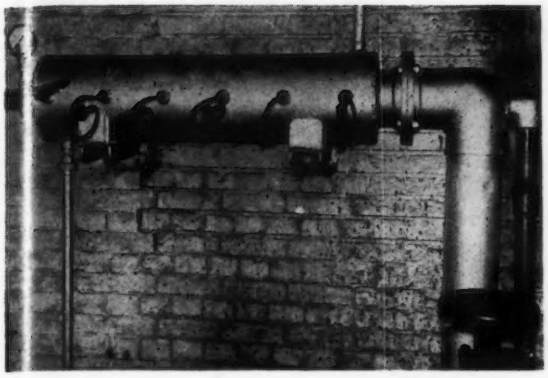

Fig. 4. The carbon dioxide purging manifold.

does give results suitable as a rough guide. There is, in fact, no accurate and simple method of estimating the sulphur content of an oxide while still at work. At Ipswich the life of a box is decided upon by experience after considering the H_2S at the inlet purifiers, average mixture used, and average rate of throughput.

When first taker air was used the boxes were rotated every two days. If rotated every day reasonable working temperatures were difficult to attain, while with a three day rotation period the H_2S travelled too far down the stream for comfort. When second taker air is used the boxes are rotated every day. If rotated every two days there is an excessive and rapid increase in the second taker outlet temperature after rotating plus the fact that H_2S is allowed too far down the stream.

The percentage removal of H_2S in first taker position is normally looked upon as a measure of the efficiency of a charge of oxide. On the average, at Ipswich, the percentage efficiency of a box falls during its life from 90% to 32%.

This percentage efficiency may be misleading for it does not take into consideration the actual volume of gas being treated. By using the same H_2S figures as used for calculating a charges percentage efficiency plus the corrected gas throughput during the previous 24 hours an approximate indication of the work done by the charge can be calculated, provided, of course, that the boxes have not been rotated during this time. This figure of work done can give a better indication of the falling efficiency of a charge than the percentage efficiency.

Moisture Control

Due to the high H_2S concentration of the gas to be purified and the slow dissipation of heat the maintenance of a reasonable quantity of moisture in the oxide is difficult. The various methods of carrying moisture into, or forming within, the purifiers has been stated by Dr. Moignard to be: (i) At the charging of a box; (ii) As vapour droplets or mist in the inlet gas; and (iii) By the oxidation of H_2S. It can be introduced: (iv) As liquid, by spraying; and (v) as steam.

To this list might be added the moisture in the air for revivification which amounts to approximately 100 lb. per day at 4½ mill. cu.ft. throughput with 1.2% O_2 addition by using air at 52°F. with a relative humidity of 65%.

At Ipswich the practice of admitting open steam to individual boxes was commenced in 1947. The steam supply is connected to the inlet manifold and with the present system it passes from a common pipe at 25 lb. per sq. in. through a stop valve and a $\frac{5}{32}$ in. nozzle (the same type as used in Woodall-Duckham continuous vertical retorts) to the individual boxes. Although this open steam does add moisture to the purification system at 40 lb. per hour it is mainly used as a means of temperature control.

A method of open steam admission to the inlet main, known as the humidifier, was put to work in 1953 and consists of an ½ in. pipe with a closed end suspended in the main and having two $\frac{7}{32}$ in. diameter holes drilled 6 in. apart. This humidifier has been worked at various pressures.

Water spraying of the gas entering individual boxes was commenced during April, 1955. The atomizing sprays at present fitted to deliver 40 lb. of water per hour at 60 lb. per sq. in. Larger sprays to deliver 100 to 200 lb. per hour at 10 to 70 lb. per sq. in. will shortly be installed.

A closed steam preheater is fitted in the inlet main and is capable of raising the gas temperature from 60°F. to over 100°F. Water connections have also been fitted to this preheater to help cool the inlet gas during the summer.

The humidifier is used continuously whenever outlet gas temperature conditions allow while the water sprays are, at the time of writing, being used continuously on all but the first taker. It may be necessary to reduce the water spraying at times during the winter months. We are endeavouring to increase the moisture content of the discharged oxide in order to increase the oxide's specific heat and so reduce the high temperatures that are reached during the summer months. A higher moisture content would also reduce the dust nuisance which we have suffered with some boxes.

Air Admission

Since May, 1955, air for oxide revivification has been blown into the stream by a Holmes blower driven by an electric motor fitted with a variable pulley. The air entering the purifiers is measured by an orifice meter recording on an Arkon air flow recorder fitted in the instrument board for the C.W.G. purifiers. (Figure 5.) The air passes through a 6-in. pipe to a common pipe running the length of the purifier house off which are taken six inch pipes to the individual purifier inlets. Air to each purifier is controlled by a 6-in. valve. The quantity of air being blown is controlled by the day staff and shift foremen according to the volume of gas metered. The percentage of oxygen to be admitted is decided upon by the day staff. Except for a few weeks during August and September the air has been blown into the second taker. So far no improvement has been noticed in the condition of the discharged oxide. With second box air admission there is little or no revivification in the first taker position so that after rotating the purifiers there is rapid oxidation of the new second taker with a large increase in outlet gas temperature.

Conclusion

It is felt that the primary cause of such purification difficulties that have been experienced at Ipswich is the high hydrogen sulphide content of the inlet gas.

Various methods of overcoming or reducing this suggest themselves:—

(a) Carbonizing coals of lower sulphur content.
(b) Mixing of carburetted water gas with coal gas prior to the purification plant.
(c) Scalping of a portion of the H_2S by a liquid purification plant prior to the dry purifiers.

Unfortunately, each method has its disadvantages.

If the concentration of H_2S continues to rise purifiers will have to be discharged more frequently which might necessitate a change in the present method of preparation for, and discharge of, a purifier. At present purifiers cannot be discharged at shorter intervals than two or three weeks without an increase in the labour force or overtime working by the present labour force.

It might be mentioned at this point that the second set of deep purifiers at Ipswich are handling carburetted water gas containing 300 grns. of H_2S per 100 cu.ft. This H_2S concentration will also increase with any increase of sulphur in the coals received.

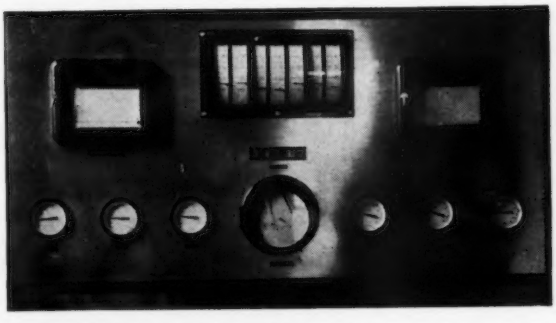

Fig. 5. The instrument panel for the water gas purifiers, including the air recorder for the coal gas purifiers.

Wales and Mon. Juniors Visit Aberavon Works

The Wales and Mon. Junior Gas Association visited Aberavon works at Port Talbot for their November meeting. Prior to the tour of the undertaking members were welcomed by Mr. W. F. Edwards, general manager, who said that they were delighted and indeed honoured by the visit of the Association and hoped that the visit would prove worthwhile.

Outlining the history of the Aberavon project, Mr. Edwards paid especial tribute to the wisdom, courage and the sagacity of Mr. R. M. Edwards, full time member of the Board. Fifteen years ago Mr. Edwards persuaded his Gas Committee, his full Council, and indeed the Steel Company of Wales as well, to enter a contract for 60,000 cu.ft. of coke oven gas per hr. In 1945 the contract was extended to 100,000 per hr., and in 1948 to 280,000 per hr. In 1946, when the 280,000 was a strong probability, the Ministry of Fuel and Power convened a meeting of representatives of gas undertakings in the area, both privately and municipally owned, to explore the possibilities of undertakings utilizing the increasing quantities of gas that would become available from the coke ovens.

In 1948 the working party presented its report on a scheme for a gas grid in the South Wales western area. Thus on Vesting Day 1949 the Board received an outstanding and valuable asset in the 280,000 per hr. contract and a mine of information in the working party's report. The report has since been acknowledged by the Board as the basis of the existing western grid, and certainly the 280,000 cu.ft. per hr. has been utilized to the full by way of the grid.

Development Project

The next step was to plan Aberavon works on the basis of purifying and compressing 280,000 cu.ft. per hr. and to make a fundamental addition of a 6 mill. cu.ft. per day C.W.G. plant, making a total of 14 mill. cu.ft. per day.

The development commenced, but there was an accompanying difficult task. That was to keep the supply going to practically the whole of the Mid-Glamorgan group, and in due course to Neath and Swansea. Mr. W. D. Rees and the staff showed devotion and vigilance throughout this period, which is only now ending. The task can be judged from the following figures—an output of 5.2 mill. cu.ft. per day, holder storage of 250,000, and dry gas plant of 2.5 mill. cu.ft. Temporary purifiers had to be sought, dismantled and re-erected and temporary compressors installed. The area of the works pre-development was six and a half acres, the principal plant being a million a day vertical house, boilers and holder, and we were bounded on one side by a lake which was filled in the lake with 230,000 tons of sand, gaining ten acres.

In 1950 the foundations of the one and a half mill. capacity gasholder were laid and then the foundations of the 10 mill. cu.ft. reinforced concrete purifiers. All the time volumes of drawing office work poured forth, tenders were prepared, invited and accepted and orders placed. Protracted delivery dates were a problem but the C.W.G. plant, boiler plant, compressor house and compressors all came into the picture as time went by. The task of the works will be to supply gas of proper standard to every Undertaking west of Bridgend right down to Pembroke Dock with recompression at Llanelly.

Members of the Association were conducted around the plant by Mr. Edwards and by the engineer, Mr. W. D. Rees. It is expected that the £1,250,000 plant will be officially opened in about 12 months' time.

Evening Classes

The Sir John Cass College, Jewry Street, Aldgate, London, E.C.3, announce a series of evening lectures and courses for 1956. The Department of Chemistry will hold two interesting series of lectures. 'Chemicals from Petroleum' by M. A. Matthews, D.S.C., is to be held on four Thursday evenings at 6 p.m. from February 9 on the scope and trends of the industry. It is hoped to include a visit to Shell chemical plant, Stanlow at the end of the course. On Friday evenings, a course of eight lectures entitled 'Distillation,' by G. A. Dunnett, M.A., and designed for industrial chemists and chemical engineers, will be held beginning on January 20. Fees for these two courses are 10s. and £1 (for those residing in the administrative County of London) respectively. Further details and enrolment forms can be obtained from the Secretary at the address given above.

'NEW HOMES FOR OLD' DEMONSTRATION

View of the North Eastern Gas Board's display room at the 'New Homes for Old' demonstration in Leeds.

In collaboration with the Ministry of Housing and Local Government, the Leeds City Council recently took over four Victorian terrace houses in Leeds some 75 years old so that they could demonstrate how such houses could be given a new lease of life by converting them into smaller units.

The North Eastern Gas Board together with the local Electricity Board and the Coal Utilization Council each co-operated by way of demonstrating alternative types of fuel service, and two of the four houses were completely furnished by one of the local departmental stores. One of the main purposes of this demonstration was to encourage house owners to take advantage of the grants which are available to them to carry out improvement and conversion work under the provisions of the Housing Rents and Repairs Act. The demonstration houses were open for inspection to the public each day for approximately four weeks. No. 78, the first of the four houses, is left unconverted and in its original state so that visitors could see what the houses looked like before conversion. The second house was unconverted and used for exhibition purposes.

Gas Council Film Library

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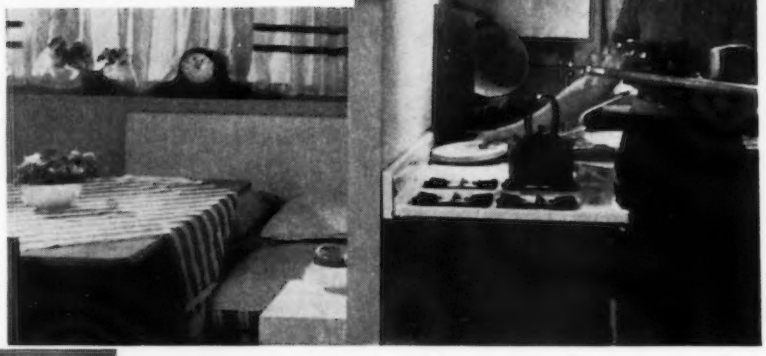
The Gas Council has just issued a revised catalogue of films on the gas industry available from its film library. The catalogue includes a number of film strips which are for sale only. No charge is made for the loan of films, some stills of which are reproduced here, so long as there is no charge for admission to the show. The catalogue includes several new titles.



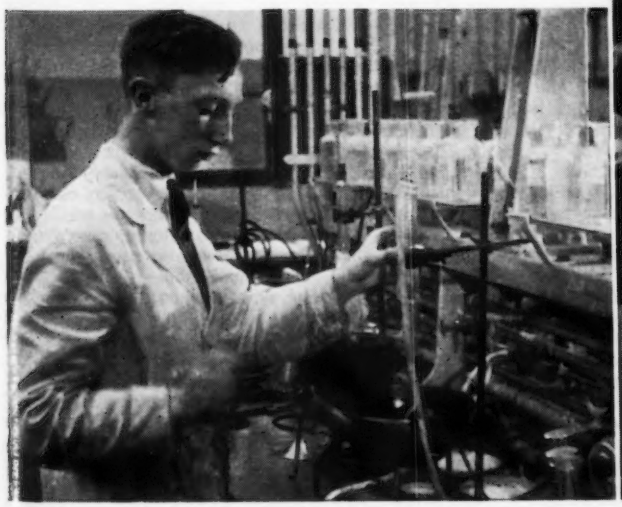
Below. *'The Vital Flame' is a documentary film showing the discovery and development of town gas, beginning with the career of William Murdoch.*

Above: *'A New Kitchen', a film designed to interest those planning an ideal kitchen.*

Below: *'The Industrious Flame'. This film shows the application of gas to modern industrial processes, here, the pottery industry.*

Right: *'The Perfect Husband', a comedy film with Richard Hearne (Mr. Pastry) and Gilbert Harding.*

Below: *'It comes from Coal', a film which tells the story of coal as a source of chemical wealth.*



GAS CONSULTATIVE COUNCILS

S.E. Tariff 'Against Hoteliers'

Is it fair that the fish-frying and bread baking trades have the benefit of a more advantageous gas tariff than hoteliers who fry fish and bake bread as part of their service? This question was posed to Mr. R. S. Johnson, M.B.E., Deputy Chairman of the South Eastern Gas Board, by Mr. H. E. Cooke, a member of the Sussex Division Committee at a joint meeting of the Area G.C.C. and District Committees on December 6. Under discussion were the 6th annual report and accounts of the Board.

Mr. Cooke said he represented the British Hotels and Restaurants Association for the area.

'The general tariff in question,' he said, 'is rather strongly against us, and while we in no way intend this as a threat, it is seriously being considered by the hotel industry as a whole, whether to change over to other methods of cooking, such as solid fuel. You might say that a quantity of the gas consumed by a hotel is resold at a profit through the meter, but I can assure you that is a very small proportion of the total. It has got to such a stage now that several are seriously considering the possibility of eliminating all gas fires from their bedrooms, substituting electric fires and changing over to solid fuel cooking.'

Mr. Johnson lumped Mr. Cooke's remarks together with a question submitted by another member of the Council, who asked: Is there a case for adjustment to the Board's industrial tariffs in view of the apparent tendency for the use of electricity and/or oil to supersede that of gas?'

Mr. Johnson said the matter was constantly under review. 'And we shall certainly take careful note of all that has been said or may be said this afternoon. Up to the present moment we had not considered that any change in the tariff structure was needed. After all, I am entitled to say that the proof of the pudding is in the eating. Our industrial sales of gas, under all the headings, show an increase of nearly £8 mill.'

One important commercial principle, went on the Deputy Chairman, was that tariffs should be so designed as to promote the increased use of gas. More therms sold, no matter to whom, would benefit all consumers.

'To take the extreme case, that we should have one tariff equally applicable to domestic and other users, you have to bear in mind that the amount of gas which a domestic consumer can use is limited. Therefore a domestic tariff will only be promotional if it allows domestic customers a reduction in price after a consumption which may be fairly substantial for a domestic user, but which may be quite insignificant for an industrial user. For that reason the Board has introduced a two-part tariff for domestic consumers which is not available to industrial consumers.'

Later, Mr. Johnson said he was not there to give any definite promises that they would introduce a new tariff. 'I regard this afternoon's meeting as progress if we have arrived at the position where you do not appear to complain of a two-part tariff which takes special care of the domestic consumer.'

Mr. Cooke: Do I understand that you are charging according to what you consider the particular industry is capable of paying? Because if so, is it your opinion that the hotel industry is the richest industry in your area?

Mr. Johnson: I did not mean to say that.

Mr. Cooke: Under the present tariffs, the new two-part domestic tariff places hotels and boarding houses, using 50 therms or more per quarter, in a position paying a higher rate than a similar domestic user. That is rather an anomaly.

Co-operation from the Unions

Alderman T. Benson asked if, 'in view of opinion prevailing with certain sections of the public on conditions of employment and reactions of employees in nationalised industries,' the Board could amplify its reference to recognition of co-operation received from trade unions.

The Deputy Chairman said the Board had closed five works during the year under review and four more since that time with the progress of integration.

That meant dispensing with the services of some employees and transferring others to different work. 'Changes of that sort could not be effected smoothly without the co-operation of the trade unions,' added Mr. Johnson. 'We are glad to recognise that we have had that co-operation.'

Other officials of the Board whom the Chairman of the Council, Mr. A. B. Constable, welcomed, were: Mr. R. H. Sandford Smith, Secretary; Mr. R. Prince, Chief Engineer; Mr. V. W. Stanton, Commercial Manager; Mr. C. J. B. Sawbridge, Assistant Chief Accountant; and Mr. A. E. Tullberg, Publicity and Information Officer. Mr. Johnson was, however, able to reply to most of the questions himself.

In a brief statement to the joint meeting, he summarized the results of the Board in the last financial year. He said that on the manufacturing side it was gratifying to be able to report that in spite of increasing costs of labour and materials production costs per therm were slightly reduced.

The Board had pursued since vesting date a policy of eliminating obsolete plant, with its heavy demands on manpower, and of concentrating manufacture at a limited number of works which could receive their raw materials most cheaply.

'In pursuance of this programme, new plant was installed during the year at East Greenwich, Croydon and Portslade, with a total capacity of nearly 16 mill. cu.ft. a day. Work on the South London integration main was nearly complete at the end of the year. This main, which cost £814,000, is now finished and links together all the principal manufacturing works in South London. In Sussex, the Portslade Works has been linked with Newhaven and Seaford.

'As a result of these measures the number of men employed on gas manufacture was reduced by over 400 although, as you know, the output of gas was up by 3.7%. Five smaller works at Horley, Redhill, Dartford, Newhaven and Seaford were closed down.'

Economies in the Bournemouth Gas Undertaking

Mr. J. T. Haynes, the General Manager of the Western Division of the Southern Gas Board, gave members of the Southern Gas Consultative Council on December 7 some very interesting details of the working of the system of 'flexible budgetary control' which has been gradually evolved during the past few years and which had resulted in very considerable economies in the Bournemouth Undertaking which was selected for a trial of the system.

He said the old and accepted method of controlling expenditure was by comparison with the results of previous years. The great changes in material, prices, and labour rates, which occurred during and after the war, had made such comparisons almost useless. Similarly, comparisons between different undertakings had little meaning because gas making plant and distribution methods differed widely in character. It would readily be realised that more effective control was by periodical comparison of actual results with a standard such as an accurate assessment of what should have been achieved with the plant then available. A firm of consultants was engaged by the Board. One team instructed the clerical and accounting staff in the assembly of cost figures, their dissection and re-grouping in order to provide a concise and accurate guide to the management of the trend of the financial aspects of the undertaking. Another team guided the technical staff in the investigation of the various operations and the formulating of standards.

Mr. Haynes proceeded to give examples of how the scheme worked.

First he referred to the time needed for the decarbonization of retorts which, he said, were usually thrown out of action for that process about once a month. The question was how long, in hours, should a retort be out of action for that purpose. Records showed that every three or four weeks retorts were out of action for periods of between three and four days. That non-productive time was thus varying between wide limits. After full discussion with works superintendents, shift foremen and even with stokers

an initial target, or standard of 84 hours per four weeks was agreed—that was 12½% of the total time. In order to do this the customary routine had to be altered, but that made no additional work for the stokers. For the next 12 months a careful check was kept of the time that retorts were in fact taken off gas producing for that cleaning process. It was found that the increased attention focussed on that feature had reduced the non productive time to even less than their target, and the standard was reduced to 12%. Since then further improvements had been made and the non-productive time due to that cause was now less than 11½%.

A similar question arose in assessing a standard time to fix a certain appliance in somebody's house. Since Budgetary Control was installed some six years ago the time for fixing that particular appliance had been reduced from 135 minutes to 105 minutes—half an hour's wages—and the reduction had been passed on to the consumer. Mr. Haynes said that these economies mentioned were only highlights. Every operation from the time the coal arrives at Poole Quay in ships, to the reading of the gas meters in peoples' houses has been 'tuned up' and he felt it was no exaggeration to state that if these savings had not been made the price of gas to-day in Bournemouth would be at least 1½d. per therm more than at present.

In conclusion, Mr. Haynes mentioned a new development in the work of economy which was being put into operation. It was based on a scheme operating in Liverpool in which fitters were supplied with their job cards several days in advance. All the materials required for the job as well as the heavy appliances were delivered to the consumer's premises by the delivery van before the job was to be done so that the fitter could proceed from his home direct to the consumer's premises and start work at 8 o'clock. The inspectors who previously were responsible for a considerable amount of paper work and form filling now had more time to visit their men on the jobs to satisfy themselves that the work was being done in a satisfactory manner.

A vote of thanks for his address was proposed by Mr. R. Craig (Oxford) and seconded by Mr. N. W. Gardiner (Reading).

Slot Meter Complaint

There was a complaint before the Council as to the difficulties householders were experiencing with penny in the slot meters of which, for instance, there were 28,000 in Portsmouth, in that they became full too quickly for prompt collection. The result was that householders could often get no gas because the coin boxes of their meters were full. The Council decided to urge the Board to replace these meters by meters which would take sixpences and coins above that value. It was also decided to accept the plan put forward by the Board for the sealing of the slot for pennies in the meters taking pennies and shillings only, having due regard to the claims of householders who would suffer hardship by not being able to put less than a shilling in the slot at one time.

LONG SERVICE PRESENTATIONS AT ROBERT DEMPSTER'S

At the annual meeting and dinner of the Sports and Social Club of Robert Dempster & Sons, Ltd., of Elland, on November 25, presentations were made to several employees who had completed 40 years' service with the firm. They were Mr. A. Earnshaw of the drawing office, Mr. G. V. Shaw of the constructional shop, Mr. F. Gale of the template shop and Mr. H. Chapman of outside erection. The presentations, which took the form of inscribed wristlet watches, were made by Councillor A. Walker, J.P., Chairman of the Elland Urban District Council, who was introduced by Mr. B. C. Morton, Managing Director of Robert Dempster & Sons. From left to right are Councillor A. Walker, J.P., Mr. B. C. Morton, Mr. A. Earnshaw, Mr. C. V. Shaw, Mr. F. Gale, and Mr. B. Chapman.

Company News

THOMAS DE LA RUE

The Directors of Thomas De La Rue & Co., Ltd., recently announced that an interim dividend at the rate of 10% actual, less tax, will be paid on the ordinary stock of the Company for the year ending March 31, 1956. Warrants are being posted today. The Board desire it to be understood that the increase in the rate of the interim dividend should not be taken as an indication that the total rate for the year will be increased.

COLONIAL GAS

The annual report of the Colonial Gas Holdings, Ltd., of Melbourne, Victoria, Australia, reveal a net profit of the year ended June 30, 1955, of £144,950. After payment on April 7 of interim dividends of 3% on preferred stock and 3¾% on ordinary stock, a total of £69,144, there remained £75,806. The directors recommended at a meeting on October 28 the payment of 6% per annum on 6% cumulative preferred stock (less 3% interim), 7½% per annum on old ordinary stock (less 3¾% interim) and 7½% per annum on 1954 issue ordinary shares, on 5s. per share January 1 to March 31, 1955, and on 10s. per share from April 1 to June 30, 1955. After paying these dividends and taking into account £11,958 brought forward at July 1, 1954, a balance of £14,395 would be carried forward to the next accounts. The directors reported that total sales of gas increased by 5.3% as against 1954, and that the price of gas was reduced in Melbourne by an average of 4½d. per 1,000 cu.ft.

Simple Hire of Appliances

The Gas Council state that, in agreement with the Central Electricity Authority and the area electricity boards, no new appliances will be fixed by area gas or electricity boards on simple hire terms from January 1, 1956. Appliances which were previously on hire and which are returned to the Boards for reconditioning will continue to be let out on hire so long as the pool of such appliances last. The agreement is for a period of two years, towards the end of which it will be reviewed.

No decision has yet been announced in Scotland regarding the termination of hiring facilities for gas cookers, following on the English decision. The view taken in Scotland is, however, that a similar decision must follow there, since the English and Welsh decisions have been taken at national level, making it very probable that the ruling will ultimately be binding nationally. At present a very considerable hire trade is done, and this has been expanded by the more stringent h.p. conditions which have applied.

The view is held unofficially that essentials such as cookers are being sacrificed by some householders for more attractive items, and that a need to either purchase outright or taken h.p. agreements would put the position into proper perspective.

The Segas Journal, magazine of the South Eastern Gas Board, features in the November issue an illustrated description of the British Gas Light Company Stations at Petworth, Billingshurst, and Storrington.

. . . . . are created by public acclaim. Cinema audiences acclaim lovely and sophisticated Kay Kendall, who stars in the film "Simon and Laura" — and housewives acclaim the Century Cooker, which features in thousands of modern kitchens throughout the British Isles.

The roles of these two stars in contemporary life are in widely differing fields, but the pre-eminence of both is the result of their fulfilling the exacting demands of their respective roles.

Star features of the CENTURY

★ Vitreous enamelled surfaces throughout ★ Cream exterior ★ Removable double platerack ★ Used oven heat vented in front of backplate to heat platerack ★ Four fast-boiling hotplate burners with taps having fixed stop for simmering ★ Large quick-heating grill ★ Safety-type taps ★ Hotplate parts removable ★ Roomy oven—base suitable for slow cooking ★ Mainstat oven-heat control ★ Drop-type oven door ★ Oven lights from front by flash tube ★ Storage space in plinth ★ Hotplate side extensions and gas lighter supplied if required

★ Kay Kendall co-stars with Peter Finch in "Simon and Laura", a Rank Organisation release.

R. & A. MAIN LIMITED LONDON AND FALKIRK

C-1

The MAIN No. 20

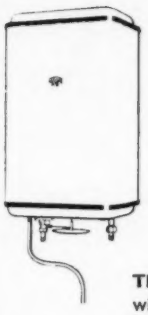
CENTURY

COOKER

C61

Note the name - made by MAIN

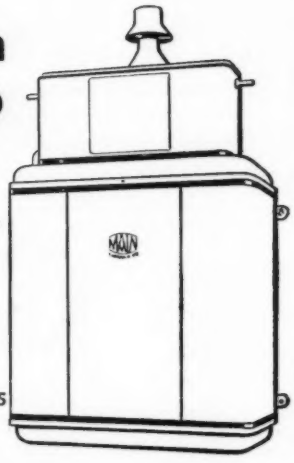
constant hot water . . .



for the sink or wash basin . . .

The Thermain No. 2 with 2 gallons capacity. Finished in cream or white enamel and with black decoration.

or from any tap in the house..



The Thermain No. 15 Multipoint with 15 gallons capacity. Finished in white or cream enamel paint.

from MAIN storage water heaters

. . . There's one for every domestic purpose

MAIN WATER HEATERS LTD.

Gothic Works, Thornton Road, Croydon, Surrey

W32

SIX PURIFIERS, EACH 50 FT. × 30 FT. × 8 FT., ERECTED IN THE MIDLANDS.

COMPLETE PURIFIER INSTALLATIONS

WITH BOXES IN C.I. OR STEEL

C. & W. WALKER, LTD. DONNINGTON Nr. WELLINGTON—SHROPSHIRE

'Phone : Wellington-Shropshire 12 'Grams : "Fortress," Donnington-Shropshire

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GAS METERS

D1—200c.ft. Approved by Ministry of Fuel & Power

Milne (Edinburgh) Ltd.

MILTON HOUSE WORKS
MILTON STREET
EDINBURGH · 8

LEEDS BRANCH · MIDLAND METER WORKS · VICTORIA ROAD

GAS FEATURED AT FARMING SHOWS

Poultry Show

Poultry, live or 'in the pot' is of topical interest at this season, and at the National Poultry Show, which was held on December 8, 9 and 10, the complete saga of the chicken from egg to oven, through all its stages, was on exhibition. One of the many attractions was 'Chicken in the Kitchen' where new and exciting ways of cooking poultry and egg dishes, including a lesson in carving by a well-known chef, was given in the Gas Council's demonstration kitchen by Mrs. Joan Robins, the well-known television housecraft expert, who cooked and prepared her own special recipes. Among these was grilled chicken—an American way of serving a bird, which is fast becoming popular in this country, with the increased use by poultry keepers of radiant heat brooders designed for the quick rearing of broilers (chickens for grilling). 'Chicken in the Kitchen' was opened by Lady James Turner, wife of the President of the Farmers' Union.

The latest gas equipment was used and visitors had the unique opportunity of watching a souffle rise in the oven through the glass door of the latest gas cooker.

General views of the Gas Council's stands at the Smithfield Show, Earls Court, and the National Poultry Show, Olympia. Above *at the Poultry Show and* below *at the Smithfield Show are a gas boiler, gas fat clarifier, and gas steam-raising boilers.*

Behind the demonstration kitchen the preparation room—a complete kitchen in itself—could be viewed through a large glass window. Here all the activity and work preliminary to the actual demonstration could be watched.

In addition to the kitchens there was a display of gas equipment suitable for large or small households. These included cookers, refrigerators and water heaters, together with some portable appliances such as boiling rings or grills.

Smithfield Show

Some of the ways in which gas and coke can help to ease the day's work—for both the farmer and his wife—were shown on the Gas Council's stand at the 1955 Smithfield Show held at Earls Court from December 5 to 9. Equipment displayed included an overhead gas-operated panel heater, coke and gas boilers for steam raising, a wide range of water heaters and models of coke-fired grass and grain driers.

Refresher Courses for Engineers

The Education Committee of Incorporated Plant Engineers announce that their comprehensive Refresher Course for works and plant engineers in London and the Home Counties, which commenced at the Royal Empire Society in November, has surpassed the enrolment records set up by their previous Courses in other parts of Britain. 550 engineers have been entered for it, and some hundreds of further applications have had to be declined as all available accommodation is fully committed.

The Committee have now organized a shortened version of the London Refresher Course for the benefit of senior works and plant engineers in Hampshire and the adjacent counties. Sponsored by Sir Henry Tizard, G.C.B., D.SC., F.R.S. (Pro-Chancellor of the University of Southampton), it will consist of 12 weekly lectures from the London Course syllabus given by the same lecturers, and will be held at Southampton University on Tuesday evenings commencing on January 17. Designed, like the London Course, to encourage the most effective use of existing knowledge and to promote the application of up-to-date techniques in works engineering practice over a broad field, its purpose is to help Works and Plant Engineers to make the fullest possible contribution to increasing productivity. The fee for the course is two guineas, and copies of the syllabus and full particulars may be obtained from the Secretary to the Refresher Course, The University, Southampton (telephone: Southampton 54071).

Value of Gas to the Pottery Industry

'The manufacture of pottery' came under review at the meeting of the Midland Junior Gas Association at Birmingham on November 29. The President of the Association (Mr. S. C. Crathorn) occupied the chair. The meeting was largely of an informal character and an interesting talk on the subject was given by Mr. F. W. Kerry of Doulton and Co. Ltd., Stoke on Trent; there was also a film illustrating in a lucid manner 'Fine Tableware in the Making' made by his company.

Mr. Kerry emphasized the great importance of the pottery industry in relation to the gas industry. He pointed out that the annual consumption of gas at the Burslem factory of the company is 157 mill. cu.ft. of gas or 737,000 therms per annum. This consumption of gas is comparable with the annual consumption of such towns as Congleton, Lichfield, Sedgley and Tamworth. The firm has ten tunnel ovens in use in the factory and in addition an intermittent kiln which employs town gas as a reducing medium for the manufacture of Rouge Flambe ware. During the past year ended March 1955 the total output of gas for the actual firing of ceramic goods in Stoke-on-Trent was 5,905,641,000 cu.ft. which showed an increase of 500% on output in 1945 of 1,194,217,000 cu.ft. It is estimated that the nearly 6,000 mill. cu.ft. of gas used in 1954-55 replaced a quantity of approximately 420,000 tons of coal which would have been used in the raw state in bottle kilns.

Gas, Electricity or Both?

Half of the houses erected by Fife County Council have been fitted with gas cookers and gas boilers. The others have electric appliances. Fife Housing Committee is to decide next month whether to drop this arrangement and use only one system. Asked on December 6 what was behind this idea, Mr. R. S. Lawrie, county architect, said they had to pay service charges for having gas or electricity laid to houses. Some members thought there would be a saving if only one service was taken to the house.

Mr. A. Eadie, Coaltown of Wemyss, who presided, said they would want to know the relative costs of gas and electricity before deciding. It was agreed the housing sub-committee should obtain these figures and go into the matter.

The London Meeting on increasing productivity by welding is to be held at the Institution of Electrical Engineers, Savoy Place, W.1, on January 12 and 13, 1956. This is one of a series of two-day meetings at which recent developments in welding and design technique are considered. The lectures are arranged by the British Welding Research Association and are given at various centres throughout Great Britain.

Western Juniors Visit Bath

The Western Junior Gas Association visited its birthplace, Bath, on Saturday December 3, for an interesting and vigorous meeting. In the afternoon members toured the works, having the new liquid purification plant, the concentrated ammoniacal liquor plant and the benzole extraction plant as items of special interest to see. The guides were kept busy answering the many questions on all these three plants.

After the tour of the works, some 90 members filled the works drawing office to capacity for the business meeting. The President, Mr. D. J. Maunder (Torquay) welcomed visitors to the meeting, particularly Mr. L. P. Ingram, Chief Engineer to the Board.

Mr. M. Gillett, a member of the Association, was congratulated by the President on his award of the Maclay Prize of the Institution of Gas Engineers, and the President said he was very happy to present Mr. Gillett with a cheque from the Association in recognition of his achievement. The President also presented the Honorary Members' Prizes to the winners—First prize to Mr. E. Luscombe (Taunton) for his paper 'Industrial Development in the Rural Areas' and Second Prize to Mr. R. Miller of W. J. Jenkins & Co. for his paper 'The Bude Contract.' Mr. Maunder said it was encouraging to see the membership of the Association growing, and he welcomed an additional 11 student members and five ordinary members to the meeting.

Mr. Maunder then introduced Mr. Aspinal and Mr. Moore of Robert Dempster & Co., who had come to present a paper on the 'Gas Technique, a new development in methods of purification,' based on work developed in Germany, particularly in Oberhausen. Mr. Maunder considered that the Association was very fortunate in having a preview of these new developments, which would be new to most members. Mr. Moore the Chief Chemist to Robert Dempsters, presented, with the aid of a small model and slides a most interesting paper, which held the attention of his audience.

Mr. Ingram, in opening the discussion stated that a plant of the type described in the paper had been ordered for erection in the Bath/Bristol Division of the South Western Gas Board. It was, he thought, a development of great importance to the industry in this country, and he was optimistic about it and wished Robert Dempster & Co. every success in their work. The paper provoked an interesting and full discussion, and Mr. Moore showed considerable brilliance in the way in which he answered all the questions put to him. In winding up the discussion and thanking Mr. Moore and Mr. Aspinal for the paper, Mr. Ingram said it was encouraging to see so many members of the Association giving up a Saturday afternoon to attend the meeting. He had visited the first plant embodying the new process described by Mr. Moore and he knew Mr. Ingram was optimistic in his hopes for the plant to be installed in his own Division.

Gas Industry Statistics

During the six months ended September, 1955, the gas industry has felt the effect of the hire-purchase restrictions imposed in February. Sales of cookers and water heaters were substantially reduced by 29% and 44% as compared with the corresponding period of the previous year. Sales of gas again show the steady rise in industrial use with an increase of 5% over the corresponding period of the previous year. Domestic sales were ½% up, and as commercial sales increased approximately 2%, the total sales were 2% up on the previous year. Coal gas made increased by 2.1% and water gas made fell by 24%. Coal carbonized was 1.8% up and there was a fall of 26% in oil used.

In the six months under review, the production of coke increased over 3% above the corresponding period of the previous year. Coke used in water gas production was reduced by 22%, but sales of coke were nearly 4% up on the previous year. Stocks of coke which had fallen to very low levels at the end of the last financial year have increased substantially and are now over 1 mill. tons. Crude tar production increased by 4%, but crude benzole production fell by 4% in the six months ended September, 1955. New gas making capacity to a total of 32 mill. cu.ft. per day was completed and brought into operation during these six months; this was a smaller figure than in the corresponding period last year.

Staggered Payments for Gas Accounts

'Pay-as-you-go' for gas and electricity is the ambition of Bootle (Lancs.) Council, and a scheme is being submitted to the authorities by which it is suggested domestic consumers will be able to buy stamps of nominal value from service centres which would later be accepted as payment towards the quarterly accounts. The chairman of the Bootle Finance Committee (Alderman Peter Mahon) hopes the gas and electricity boards will accept the scheme because it would help housewives and particularly old age pensioners to whom quarterly accounts came as a shock and upset their budget. He claimed the scheme would mean fewer bad debts for the gas and electricity boards.

A culinary duel will be staged by the Gas Council, in co-operation with Mr. Charles Forte, Chairman and Managing Director of Fortes and Company, at the Café Royal on January 9, 1956. The challenger is M. Raymond Oliver, Patron chef of a three-star Paris restaurant and France's television cook. Early this year he issued a challenge 'to any woman in the world and particularly any English woman' to match his creative cooking. It was accepted by Mrs. Phyllis Cradock—feminine half of Bon Viveur, the famous food journalists and well-known stage and television stars.

PUBLISHERS' NOTICE

The " Gas Journal " is published every Wednesday, price **1/6d.**; by post **1/8d.**

Subscription Rates: Home and Empire:—**60/-** per annum; Foreign:—**70/-** per annum. (Both payable in advance.) A copy of the " Gas Journal " Calendar & Directory is presented each year to continuous subscribers.

Classified Advertisements: All small classified advertisements are charged at **2/-** per line (approx. **7** words)—minimum charge **10/-**. A Box Number address occupies **2** lines, and a further **6d.** is charged towards cost of postage on replies. Copy must be received by first post on Monday to ensure insertion in that week's Journal.

Displayed Advertisements: Rates obtainable on application to the Business Manager. Change of copy for displayed spaces must be received **14** days prior to publication if proofs are required. Type area of inside pages **10** in. deep × **7** in. wide; block screen **120**.

BUSINESS MANAGER: S. T. CULLEN

MIDLANDS MANAGER: G. B. Torrance, 42, Wychall Lane, King's Norton, Birmingham, 30. *Telephone:* King's Norton 3868.

NORTHERN MANAGER: Philip W. B. King, Flat 1, 7 Langcliffe Avenue, Harrogate. *Telephone:* Harrogate 67625.

SOUTHERN REPRESENTATIVE: A. Engelhardt, T.D., 11, Bolt Court, Fleet Street, E.C.4. *Telephone:* Fleet Street 2236-7.

WALTER KING, LTD., 11, Bolt Court, Fleet Street, London, E.C.4.

Telephone: FLEet Street 2236-7. *Telegrams:* Gasking, Fleet, London.

COMPRESSORS & EXHAUSTERS FOR AIR AND GAS.

See our Advertisement Next Week.

REAVELL & CO. LTD. IPSWICH.

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Quarterly Volumes of the 'Gas Journal'

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Oxide supplied on loan or sale outright.
Highest prices paid for Spent Oxide

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Telegrams: "Purification, Stock, London." Telephone: London Wall 7938/9 & 7930

PATENTS

KINGS PATENT AGENCY, LTD.

(Director, B. T. King, A.I.M.E., Patent Agent) Advice, Handbook, and Consultations free. 146a, Queen Victoria Street, London, E.C.4. 'Phone: City 6161.

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FIBRE BRUSHES
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"KAY-DEE" *

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OURS ALONE ?

YES, FACE IT:

FOR 5 MINUTES !

We must fight the Fire Fiend ALONE before the Fire Brigade gets here. Please send details of NU-SWIFT rapid and reliable Fire Extinguishers—BEFORE IT IS TOO LATE!

Name.....

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Post NOW to Nu-Swift Ltd. 25 Piccadilly W.1.

In Every Ship of the Royal Navy

APPOINTMENTS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

WEST MIDLANDS GAS BOARD

WOLVERHAMPTON AND DISTRICT DIVISION
TECHNICAL ASSISTANT,
STOURBRIDGE WORKS, SOUTHERN GROUP

CANDIDATES should preferably have experience of the control and working of Woodall-Duckham vertical retorts, automatic water gas plants and the manufacture of concentrated liquor. The successful applicant will normally be employed at the Stourbridge Works but may be required to undertake duties at other Works in the Group.

The salary will be within Grade 5 (£530-£610 per annum) of the National Salary Scales for Gas Staffs.

A house adjacent to the Works will be available for the person appointed, at a reasonable rental.

The post is pensionable, and the successful applicant may be required to pass a medical examination.

Applications stating age and experience, together with the names of two referees, should be addressed to Mr. Stanley Jones, Divisional General Manager, West Midlands Gas Board, Kensington House, Bath Street, Dudley, to reach him not later than December 21, 1955.

J. C. INGRAM,
Secretary to the Board.

MAINTENANCE ENGINEER

APPLICATIONS are invited for the position of Maintenance Engineer at a modern Coke & By-Product Plant in South Wales. Applicants should have a sound knowledge of the installation and maintenance of Mechanical and Electrical Plant. Applications giving age, qualifications, details of experience and salary required should be addressed to: No. 267, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

WALES GAS BOARD

THERE is a vacancy for a FIRST CLASS GAS FITTER in the Carmarthen Group of Undertakings. J.I.C. conditions and rates of pay (Provincial 'B' rating).

The successful applicant may be required to work anywhere within the Group. Housing accommodation (three bedroomed house with bathroom) is available under a standard Service Occupation Agreement.

Applications, stating age, experience and qualifications and giving the name of a referee, should be sent to the undersigned not later than December 31, 1955.

K. E. TIDDY, M.Inst.Gas E.,
Engineer & General Manager.

Gas Works,
Morfa Lane,
Carmarthen.

TECHNICAL ASSISTANT
FOR
TOWNSVILLE GASWORKS, QUEENSLAND, AUSTRALIA

THE Townsville Gas & Coke Co., Ltd., require a TECHNICAL ASSISTANT, preferably unmarried and aged 23-28 years.

Salary: First year £1,000 per annum Australian Currency.
Second year £1,100 per annum Australian Currency.
Third year £1,200 per annum Australian Currency.

Single fare in a one class ship from England to Australia will be paid and salary will accrue from date of embarkation. Successful appointee to agree to remain in the employ of the Townsville Gas & Coke Co., Ltd., for a minimum period of 3 years.

The above company is a subsidiary of Colonial Gas Holdings, Ltd., which operates 21 gas undertakings in Australia and there are good opportunities for advancement within the parent company. Gas output at Townsville is approximately 100 m'll. cu.ft. per annum, produced in Woodall-Duckham intermittent vertical retorts.

Appointee should preferably have passed the Institution of Gas Engineers' examination (manufacture) at the higher grade and have all-round gasworks' training.

Applications for the above position should be addressed to: No. 268, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

Classified advertisements continued on page 744)

APPOINTMENTS VACANT (ctd.)

DRAUGHTSMEN required experienced in Gas and Chemical Engineering. Pension Scheme. Five-day Week and Canteen facilities. Apply: W. C. Holmes & Co., Ltd., P.O. Box B.7 Turnbridge, Huddersfield.

LABORATORY ASSISTANTS (Male)
age 20-25
are required by
NORTH THAMES GAS BOARD
in laboratories at
HORNSEY, N.8 — BECKTON, E.6,
POPLAR, E.14, and SLOUGH, BUCKS.

CANDIDATES should have attained University Entrance level for a Science Faculty or hold Intermediate B.Sc. qualifications or have obtained exemption from matriculation.

Starting salaries within the range £410-£505 per annum according to age.

Applications giving age and full particulars to Staff Controller, 30, Kensington Church Street, W.8, quoting reference 666/305.

NATIONAL COAL BOARD

DURHAM DIVISION
CARBONISATION GROUP MANAGERS

APPLICATIONS are invited for the posts of GROUP MANAGERS for groups of five or six coking plants in East, West and North Durham.

Applicants should have had a wide experience of the operation and supervision of Coke Oven and By-Products plants, and in addition to technical qualifications should possess administrative ability.

Salary range: £1,500-£2,000.

Applications to be submitted within seven days to Staff Director, National Coal Board, Durham Division, 'D' Floor, Milburn House, Newcastle-on-Tyne, 1.

Please quote reference No. E.V. 36.

THOMAS GLOVER AND CO., LTD.

GAS METER MANUFACTURERS
BRANCH MANAGER—BELFAST

APPLICATIONS are invited for the above appoint- ment which covers the management of an establishment engaged upon the assembly and testing of gas meters and, at present, also the assembly of gas cookers.

Candidates should possess technical and managerial experience in the Gas Industry or in Light Engineering and similar industry. Some knowledge of sheet-metal work and the construction and maintenance of Gas Meters and Cookers, while by no means essential, would be advantageous.

The successful Candidate will be expected to reside in or near Belfast, and to exercise control over the Branch Factory, subject to the general direction of the Manager of the Company's principal Factory in London, with whom close contact must be maintained.

The commencing salary for the position will be at the rate of £700 per annum and the successful Candidate will be required to pass a medical examination and also to join the Company's Staff Superannuation Scheme.

Applications stating age, qualifications, experience, present appointment and salary, and accompanied by the names of two referees should be addressed to the Managing Director, Thomas Glover and Co., Ltd., 48, Grosvenor Gardens, London, S.W.1, to arrive not later than Friday, December 30, 1955.

SCOTTISH GAS BOARD

PERTH GROUP
TECHNICAL ASSISTANT (DISTRIBUTION)

APPLICATIONS are invited for the post of TECH- NICAL ASSISTANT (DISTRIBUTION) at Perth. Experience in Sales, Installations and/or Mainlaying work would be an advantage. The Salary offered is Provincial A Grade A.P.T. 6 (£565/£645 per annum), with placing according to qualifications and experience. The post is pensionable and the person appointed will be required to pass a medical examination.

Applications, stating age, education, training, qualifications and experience, should reach the undersigned not later than December 21, 1955.

W. NICOL BAIRD,
Group Manager.

SCOTTISH GAS BOARD

WESTERN GROUP
GREENOCK, GOUROCK & PORT GLASGOW DISTRICT
ASSISTANT DISTRIBUTION SUPERINTENDENT

APPLICATIONS are invited for the post of ASSISTANT DISTRIBUTION SUPERINTENDENT in the above District.

Applicants should have a sound theoretical knowledge and practical experience in both Mains and Fittings work; Drawing Office experience would be an advantage.

The commencing salary will be within the range of A.P.T. Grade VI (£565-£645 per annum), according to qualifications and experience. A house at a rental will be available. The successful candidate may be required to pass a medical examination.

Applications giving age, education and qualifications, together with full details of posts held and experience, should be addressed to the undersigned to reach him within 10 days of publication of this advertisement.

WILLIAM KIRK,
District Manager.

Inchgreen Gas Works,
Greenock.
December 6, 1955.

SCOTTISH GAS BOARD

DUNDEE GROUP—DUNDEE DISTRICT
TECHNICAL ASSISTANT (CONSTRUCTION)

APPLICATIONS are invited for the position of TECHNICAL ASSISTANT (CONSTRUCTION) with the Dundee Undertaking of the Scottish Gas Board.

Applicants must have experience in the preparation of Specifications, Estimates, Layout of Works Plans for development of Works Plant, Structural Development, and Supervision of Erection of New Plant. They must be University Graduates, or Corporate Members of an Engineering Institution.

The salary applicable to this post will be within Grades A.P.T. 7/8 of the National Salary Scales (£620-£740 per annum) with placing according to experience and qualifications. The post is superannuable and permanent appointment is dependent on the successful passing of a Medical examination. Applications, stating age, training, experience and qualifications, together with any Testimonials, should be lodged with the Undersigned within 14 days of the appearance of this advertisement.

W. S. JOHNSTON, B.Sc., M.Inst.Gas E., M.Inst.F.,
Group Manager.

Scottish Gas Board,
Dundee Group,
Gas Works,
50, East Dock Street,
Dundee.

SCOTTISH GAS BOARD

APPLICATIONS are invited for the undermentioned appointments of Sales and Service Superintendents.

(a) South East Division, with headquarters in Edinburgh. Salary within Grade A.P.T. 10 (£810-£860 per annum).

(b) Kilmarnock Group, with headquarters in Kilmarnock. Salary within Grade A.P.T. 9 (£760-£800 per annum).

The posts are superannuable and successful candidates may be required to pass a medical examination.

Applicants should be capable of promoting and co-ordinating sales efforts, organising displays, supervising showrooms and dealing with local publicity.

Applications stating age, particulars of education, training and experience, together with names of referees should reach the undersigned by January 7, 1956.

A. T. HERD,
Secretary.

26, Drumsheugh Gardens,
Edinburgh.

TECHNICAL SALES REPRESENTATIVE required by the British Thermostat Co., Ltd., Sunbury-on-Thames, Middlesex. Applications are invited from personnel with a knowledge of Domestic Gas Appliance Design, Thermostatic and other automatic control problems. Also able to prepare own schemes and to promote long term sales. Personality, initiative and ability to negotiate at high level. Applicants must be car owners and remuneration will be by salary plus full expenses allowance. Please write stating full details of previous experience, age and salary required to Personnel Manager.

SOUTHERN GAS BOARD

CENTRAL DIVISION
READING AND DISTRICT GAS UNDERTAKING
FOREMAN/ELECTRICIAN

APPLICATIONS are invited for the above position from candidates who are fully experienced in the maintenance of all types of electrical installations, both AC and DC. Salary within the range £530-£610, per annum, A.P.T. Grade 5, with initial placings according to experience. Reply with full particulars of age, experience, etc., to Athol W. Brown, Esq., Group Manager, King's Road, Reading.

ATHOL W. BROWN,
Group Manager.

P.O. Box No. 34,
King's Road,
Reading, Berks.
December 5, 1955.

PLANT FOR SALE & WANTED

FOR SALE: NEW GAS-FIRED BOILER by Hartley & Sugden. 160 lbs./hour at 80 lbs. p.s.i., complete with chimney, spare burner and controls. Original purchase price was £419. Our price £200. W. H. COLLINGBOURNE & CO., LTD., 1481. Stratford Road, Birmingham, 28. Phone: Shirley 3303.

WANTED:—One second-hand Morris Charger com- plete with carriage framework in good working condition, suitable for four beds of 8 'D' Section 10 ft. horizontal retorts (21" × 15").

Full particulars and price F.O.Q. Drogheda to Secretary, Drogheda Corporation Gas Works, Drogheda, Republic of Ireland.

WALTER KING SERVICES—3

KING'S MANUAL OF GAS MANUFACTURE

Now being issued in 10 self-contained sections. Sections available, and prices, as below:

SECTION	1	CARBONIZATION: HORIZONTAL RETORTS	13s. 9d. inc. postage
,,	2	VERTICAL RETORTS	7s. 9d. ,,
,,	3	WATER GAS AND COMPLETE GASIFICATION	7s. 9d. ,,
,,	4	COKE OVENS	7s. 6d. ,,
,,	5	REFRACTORIES: COAL AND COKE HANDLING	7s. 9d. ,,
,,	6	GOVERNORS: EXHAUSTERS: STATION METERS	9s. 9d. ,,
,,	10	INSTRUMENTATION	5s. 3d. ,,

OTHER SECTIONS IN ACTIVE PREPARATION.

FROM

WALTER KING, LTD. 11, BOLT COURT, FLEET STREET, LONDON, E.C.4.

*THE RE-DESIGNED Western DOUBLE-FACED valve

British Patent Application No. 18892/53.

FOUNDED 1850 HOLMES HUDDERSFIELD

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HUDDERSFIELD • LONDON • BIRMINGHAM

industrial gas compressors

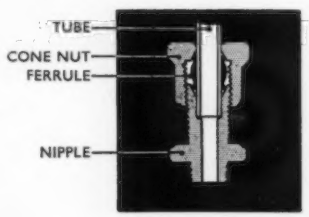
FOR COMPRESSING AIR OR GAS SUPPLIES USED FOR FURNACE HEATING, METAL MELTING, BRAZING, SOLDERING BITS, LAUNDRY, IRONS, ETC.

DIRECT COUPLED COMPRESSORS (see illustration right) are fitted with automatic internal by-pass valves and lubrication systems. They are direct coupled to Keith Blackman motors. Type OA compressors in this range occupy a floor space of only 18" x 7½".
CAPACITY RANGE: 100 to 750 cub. ft. of gas or air per hour at 3 lbs. per sq. in. pressure.

TYPE 4 COMPRESSORS (not illustrated) are also fitted with automatic internal by-pass valves and lubricators. The complete unit includes motor and drive on a common bedplate, all of Keith Blackman manufacture.
CAPACITY RANGE: 500 to 20,000 cub. ft. of gas or air per hour at 3-5 lbs. per sq. in. pressure.
AREA OCCUPIED: from 9¼" x 16½" to 61" x 27".

DID YOU KNOW?

KEITH BLACKMAN have been making compression joints for many years and the present design embodies features developed as a result of this long experience. Notice that the shape of the ferrule is such that the joint is made without unduly stressing the tube.



Keith Blackman LIMITED
MILL MEAD ROAD, TOTTENHAM, LONDON, N.17
BRANCH OFFICES: AT MANCHESTER, BIRMINGHAM, LEEDS, GLASGOW, NEWCASTLE-ON-TYNE, PENARTH near CARDIFF, AND BELFAST

serving to burn

Note: the four burner heads (right) are for high pressure gas, or low pressure gas and air blast.

LEFT: "Fishtail" type burner with two-armed stamped pattern injector for heating liquid in tanks by submerged combustion tubes. For use with low pressure gas supplies. **Size Range:** 1", 1¼", 1½", 2" and 2½" outlets. **Capacity Range:** 45-280 cub. ft. of gas per hour.

Brass non-blow-off head types: deal with 5 to 10 cub. ft. of gas per hour.

Stainless steel, "F" type head, burner: deals with 8 cub. ft. of gas per hour.

Perforated head type burner: deals with 10 to 15 cub. ft. of gas per hour.

INDUSTRIAL GAS EQUIPMENT

524

Railway Sidings Construction

Design, Installation and Maintenance

The Grant Lyon Railway Sidings installation for the new 60-ton Electric Melting Furnace Project at the Stocksbridge Works of Messrs. Samuel Fox & Co. Ltd. included: lifting 3½ miles of track from old sidings; filling up and making new foundations to a maximum depth of 12 ft. using 15,000 tons of slag; laying temporary track; laying approximately 5¼ miles of permanent track involving 39 leads, 5 tandems, 1 diamond, 5 single slips and 1 double slip.

Enquiries are invited for the design, installation and maintenance of railway sidings.

GRANT LYON
AND COMPANY LIMITED
SCUNTHORPE

Railway and Civil Engineering Contractors
HEAD OFFICE: Scotter Road, Scunthorpe, Lincs.
Phones: Scunthorpe 2308/9; Manchester DEAnsgate 7805; Swansea 25

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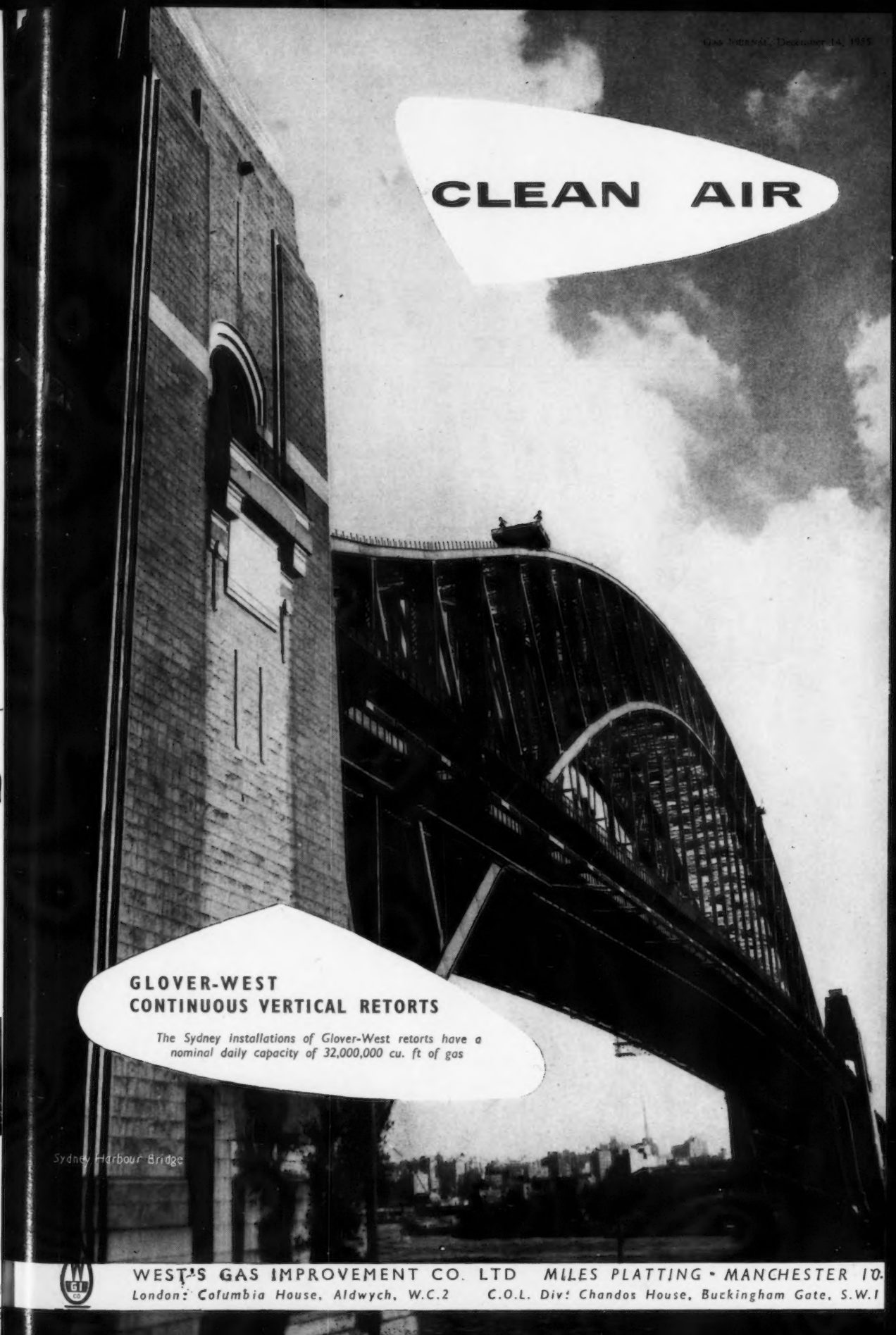
CLEAN AIR
GLOVER-WEST
CONTINUOUS VERTICAL RETORTS
The Sydney installations of Glover-West retorts have a nominal daily capacity of 32,000,000 cu. ft of gas
Sydney Harbour Bridge

WEST'S GAS IMPROVEMENT CO. LTD MILES PLATTING • MANCHESTER 10.
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There's always room for an ASCOT...

...with the tubular pillar support!

MORE and more plumbers, builders and architects nowadays are recommending the specially designed Ascot pillar support which enables the famous Ascot sink water heaters of the 503 range and the Boiling Water Heater type RS.52/1, to be fitted on almost any horizontal surface.

Designed as an alternative to conventional wall-fixing, the pillar support can be easily fixed on bar or counter tops, window sills and other flat surfaces. It obviates unsightly external pipe runs — gas and water connections are concealed.

The pillar support, which is finished in high-grade chromium plate, is ideal for licensees and caterers as well as for housewives whose kitchens have large window areas and correspondingly less wall space.

(When the Ascot Boiling Water Heater, type RS52/1 is used on a pillar support, an eccentric adaptor and lining must be used — Ascot part Nos. 6157/1Z and 0055/4X).

ASCOT

ALWAYS LEADS

ASCOT GAS WATER HEATERS LTD., 255 NORTH CIRCULAR ROAD, LONDON, N.W.10

WHG/A209